data_analysis

July 15, 2025

```
[13]: import pandas as pd
     from sklearn.model_selection import train_test_split
     import joblib
     import numpy as np
     from sklearn.feature_selection import VarianceThreshold, SelectKBest, f_classif
[14]: # Show all columns in the DataFrame
     pd.set_option('display.max_columns', None)
     pd.set_option('display.width', None)
[15]: # Load raw data
      #beniqn = pd.read_csv('datasets/hmi_normal_6h_flow_label.csv')
     scapy modify = pd.read csv('datasets/mitm hmi_scapy_modify_1plc 6h flow label.
       ⇔csv')
     fw_36plc = pd.read_csv('datasets/mitm_hmi_forward_36plc_6h_flow_label.csv')
[16]: scapy_modify.groupby("Label").describe()
[16]:
             Src Port
                                                                             \
                                                               25%
                                                                        50%
                count
                               mean
                                             std
                                                      min
     Label
     mitm
                6754.0
                       45706.734972 5553.484326
                                                  32784.0 44818.0
     normal 164457.0 45785.487161 5607.404711 32768.0 44818.0
                               Dst Port
                                                                             \
                 75%
                                  count
                                                                        min
                                                 mean
                                                               std
                          max
     Label
             45037.0 60992.0
                                 6754.0 45878.698253
     mitm
                                                       6111.837581
                                                                    32784.0
             45764.0 60998.0 164457.0 45946.057510 6071.042539
     normal
                                                 Protocol
                 25%
                          50%
                                   75%
                                                    count mean
                                                                std min
                                                                          25%
                                                                               50%
                                            max
     Label
     mitm
             44818.0 44818.0 47685.5
                                        60992.0
                                                   6754.0 6.0
                                                                0.0
                                                                     6.0
                                                                          6.0 6.0
                                        60998.0 164457.0 6.0 0.0 6.0
     normal
             44818.0 44818.0 48036.0
                      Flow Duration
             75% max
                              count
                                              mean
                                                             std
                                                                   min
                                                                         25%
```

Label												
mitm		6.0		6754.0	434630.					14.0		
normal	6.0	6.0	10	34457.0	58148.	334605) 1.4	24013	5e+06	7.0	14.0	
						Tot	Fwd P	kts				\
Tabal		50%		75%	ma	X	CO	unt	m	ean	st	td
Label mitm	6162	02.5	792774	.25 9	9088176.	0	675	4.0	2.449	067	2.45742	26
normal	578		73380		7511126.		16445		2.459		2.46689	
					To+ Dred	Dl++ a						`
	min	25%	50% 7	75% max	Tot Bwd	count	1	mean		std	min 2	25%
Label												
mitm		0.0		6.0		754.0		3154				2.0
normal	0.0	0.0	4.0 5	5.0 6.0	164	457.0	3.54	1515	1.55	3819	2.0 2	2.0
			To	tLen Fw	d Pkts							\
Label	50%	75%	max		count	n	nean		std	min	25%	50%
mitm	5.0	5.0	8.0		6754.0	47.787	'385	48.09	99579	0.0	0.0 7	72.0
normal	5.0	5.0	8.0	16	4457.0	47.981	515	48.19	93465	0.0	0.0 7	72.0
			To+I	en Bwd	Dlz+ a							\
	75%	m	ax		ount	mea	an	S	std m	in 2	5% 50	0%
Label												
mitm normal	98.0 96.0					.26917		.6609 .7562			.0 72.	
HOTMAI	90.0	100	.0	1044	37.0 38	.40100	55 56	. 1 302	200 0	.0 0	.0 12.	.0
			Fwd	Pkt Len	Max							\
Label	75%	m	ax	С	ount	mea	n	S	std m	in 2	5% 50	0%
mitm	72.0	100	.0	67	54.0 33	.75214	17 34	.1660	059 0	.0 0	.0 44	. 0
normal	78.0	100	.0	1644	57.0 33	.97853	35 34	.2842	204 0	.0 0	.0 44	. 0
			Fwd F	kt Len	Min						\	\
	75%	ma			unt mean	std	min	25%	50%	75%	max	`
Label			_									
mitm normal	70.0 68.0			675 16445				0.0		0.0	0.0	
normar	00.0	12.	O .	10110	7.0 0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	Fwd P	kt Le	n Mean			_			0/			\
Label			count	me	an	std	min	25%	50%	75%	max	
mitm			6754.0	9.7495	85 9.75	5739	0.0	0.0	18.0	19.6	28.0	
normal		16	4457.0	9.7493	39 9.75	3269	0.0	0.0	18.0	19.2	20.0	
	Fwd P	kt Le	n Std									\

	coun	t mean	std	min 25%	50%	75%
Label						
mitm	6754.		15.028194			
normal	164457.	0 14.990621	15.069873	0.0 0.0	21.786846	29.852973
	- .	.				,
		Pkt Len Max			م سنہ مدن	LV0 2L0/
Label	max	count	mean	st	d min 25%	50% 75%
mitm	34.292856	6754.0	24.265028	24.88613	4 0.0 0.0	44.0 44.0
normal	31.496031	164457.0	24.458685			44.0 50.0
HOTMOT	01.100001	101101.0	21.100000	21.02000	2 0.0 0.0	11.0 00.0
	Bwd Pkt	Len Min			\	
	max	count mean	std min	25% 50%	75% max	
Label						
${\tt mitm}$	72.0	6754.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	
normal	72.0 1	64457.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	
						,
	Bwd Pkt Len Me	_	-+ 3		F09/ 7F9	\
Inhal	cou	nt mean	std	min 25%	50% 75	/₀
Label mitm	6754	.0 7.480942	7.496550	0.0 0.0	12.375 14.4	4
normal	6754 164457		7.490330	0.0 0.0	12.000 15.0	
HOTMAT	104437	.0 1.338102	7.572102	0.0 0.0	12.000 13.	O
	Bwd	Pkt Len Std				\
	max	count	mean	st	d min 25%	50%
Label						
${\tt mitm}$	16.666667	6754.0	11.012655	11.14653	2 0.0 0.0	20.51341
normal	16.666667	164457.0	11.102558	11.20373	5 0.0 0.0	20.51341
	750		Byts/s			. 05%
T = 1: = 7	75%	max	count	mean	std	min 25%
Label mitm	20 512/10 20	.330303	6754 0 1	06.448680	107.724388	0.0 0.0
normal				64.924351	1180.243370	
HOTMAL	22.133230 29	.550505	J4407.0 II	04.924001	1100.240070	0.0 0.0
			F	low Pkts/s		\
	50%	75%	max	count	me	an
Label		,,				
mitm	1.992790 21	6.632122 33	38.550777	6754.0	35418.5333	51
normal	1.803155 235	5.486778 309	57.083121	164457.0	71186.0952	16
						\
	std	min	25%	50%	•	75%
Label						
mitm	39916.649455		12.613931	16.231172		
normal	78249.038332	0.102118 13	36.278772	172.962502	142857.142	857

	Flow max	IAT Mean count	mean	std 1	min 25%	\
Label						
mitm	142857.142857				4.0 35.0	
normal	285714.285714	164457.0 605	3.155641 1295	522.082678	7.0 14.0	
			D3 TAT O+		,	
	50%	75% m	Flow IAT St		\ oon	
Label	50%	7 5/ ₆ III	ax cour	IC III	ean	
mitm	69502.5 88088.583	333 9.008016e+	06 6754.	0 61929.003	762	
normal	6424.0 8153.222					
					\	
	std min	25%	50%	75%	max	
Label						
mitm -	455455.016393 0.0	0.0 75823.08			342e+07	
normal	429158.498273 0.0	0.0 11627.96	4869 13719.6	3.540	754e+07	
	Flow IAT Max				\	
	count	mean	std min	25%	50%	
Label	count	moun	Bod min	20%	5076	
mitm	6754.0 16551	2.691146 1.508	231e+06 14.0	35.0 194066	6.0	
normal			458e+06 7.0	14.0 36986	6.0	
		Flow IAT M	in		\	
	75%	max cou	nt mean	std	min	
Label						
mitm	276949.75 983557			1664.419176	13.0	
normal	43238.00 1174405	59.0 164457	.0 16.784807	9.151835	4.0	
		Fwd IA	Γ Tot			\
	25% 50% 75%	max	count	mean	std	
Label	00 0 00 0 00 0	100501 0 0	754 0 044500	507000 0450	00 400007	
mitm	20.0 29.0 38.0 11.0 14.0 22.0		754.0 314562.			
погшат	11.0 14.0 22.0	2004.0 104	457.0 34062.	000009 3404	47.273340	
			Fwd IAT	Mean	\	
	min 25% 50%	75%		count	mean	
Label						
mitm	0.0 0.0 470988.5	628555.0 776	518.0 67	754.0 81354.6	608528	
normal	0.0 0.0 50543.0	66317.0 156	975.0 1644	£57.0 8727.:	146386	
		050/ - **			d IAT Std	\
	std min	25% 50%	75%	max	count	
Label						
	994E7 90430E 0 0	0 0 110766 05	150060 275	252560 00	67E4 0	
mitm normal	82457.804395 0.0 8898.843536 0.0			252569.00 39243.75	6754.0 164457.0	

					\
	mean	std min	25%	50%	75%
Label mitm	74244.508187 7545	5.695403 0.0	0.0 65767.3	41155 151067.3	292561
normal		1.460605 0.0	0.0 14713.7		
	Fwd	IAT Max			\
T - 1 7	max	count	mean	std min	n 25%
Label mitm	201558.904417	6754.0 15426	4.025318 155	730.636886 0.0	0.0
normal				513.684397 0.0	
			d IAT Min		\
T - 1 7	50% 75	% max	count	mean	std
Label mitm	204687.0 307223.2	5 438777.0	6754.0 66	40.931744 1893	28.241434
normal	37016.0 43284.0				31.210742
			Bwd IAT T	ot	\
I obol	min 25% 50%	75%	max cou	nt me	ean
Label mitm	0.0 0.0 1958.0	6095.25 13570	8.0 6754	.0 431217.406	574
normal		2082.00 1940			
		05% 50	0/ 750/	`	\
Label	std min	25% 50	% 75%	max	
mitm	1.565578e+06 0.0	35.0 609929.	0 785992.25	99088176.0	
normal	1.424580e+06 7.0	14.0 54144.	0 67067.00	117511126.0	
	Bwd IAT Mean	moon	std mi	OE% I	\
	count	mean			50°/
Label			Bod mi	n 25% !	50%
Label mitm	6754.0 10289	5.405747 2375			
		5.405747 2375 3.127877 2035	57.336597 0.	0 35.0 12617	1.9
mitm		3.127877 2035	57.336597 0. 80.924270 7.	0 35.0 12617	1.9
mitm	164457.0 1144	3.127877 2035 Bwd IA	57.336597 0. 80.924270 7. T Std	0 35.0 12617 0 14.0 1194	1.9 6.6
mitm normal		3.127877 2035 Bwd IA	57.336597 0. 80.924270 7.	0 35.0 12617	1.9
mitm	164457.0 1144	3.127877 2035 Bwd IA max	57.336597 0. 80.924270 7. T Std count	0 35.0 12617 0 14.0 1194	1.9 6.6 \ std
mitm normal Label	164457.0 1144 75% 194004.9125 1.415	3.127877 2035 Bwd IA max 545e+07 6	57.336597 0. 80.924270 7. T Std count	0 35.0 12617; 0 14.0 11946 mean	1.9 6.6 std .745766
mitm normal Label mitm	164457.0 1144 75% 194004.9125 1.415	3.127877 2035 Bwd IA max 545e+07 6	57.336597 0. 80.924270 7. T Std count	0 35.0 126173 0 14.0 11946 mean 545143 569092 778109 537956	1.9 6.6 std .745766 .338481
mitm normal Label mitm	164457.0 1144 75% 194004.9125 1.415 16542.2500 1.678	3.127877 2035 Bwd IA max 545e+07 6 730e+07 164	57.336597 0. 80.924270 7. T Std count 754.0 60112. 457.0 17682.	0 35.0 12617: 0 14.0 11946 mean 545143 569092 778109 537956 Bwd IAT I	1.9 6.6 std .745766 .338481
mitm normal Label mitm	164457.0 1144 75% 194004.9125 1.415	3.127877 2035 Bwd IA max 545e+07 6	57.336597 0. 80.924270 7. T Std count	0 35.0 12617: 0 14.0 11946 mean 545143 569092 778109 537956 Bwd IAT I	1.9 6.6 std .745766 .338481

normal	0.0 0.0	14333.896201	18761.50	3636 4	1.4383926	e+07	164457.0	
							\	
Label		mean	std min	25%	50)%	75%	
mitm	173616.79	59994 1.508831	le+06 0.0	35.0	213070.	0 2939	905.25	
normal	43794.49		e+06 7.0		37471.		64.00	
		Bwd IAT Mir				. 1	. 05%	T-0"/
Label	ľ	max count	;	mean		std n	nin 25%	50%
mitm	98355743	3.0 6754.0	38636.8	16849	43667.11	4064 (0.0 35.0	105.5
normal	117440559			52025	2087.73	30052	7.0 14.0	103.0
	75%		PSH Flags	maan	a+d min) OE%	E0% 7E%	
Label	75%	max	count	mean	std mir	ı 25%	50% 75%	max
mitm	81205.25	151454.0	6754.0	0.0	0.0 0.0	0.0	0.0 0.0	0.0
normal	3182.00	13849.0	164457.0	0.0	0.0 0.0	0.0	0.0 0.0	0.0
	D 1 DGW 5	-						
	Bwd PSH F	Lags ount mean std	min 25%	50%	75% max		RG Flags count	moon
Label	C	Junt mean Sta	III 25%	30%	10% IIIax	L	Count	mean
mitm	675	54.0 0.0 0.0	0.0 0.0	0.0	0.0 0.0)	6754.0	0.0
normal	1644	57.0 0.0 0.0	0.0 0.0	0.0	0.0 0.0) 1	164457.0	0.0
			ъ.	a				,
	std min	25% 50% 75%		URG F1	.ags ount mear	n std	min 25%	50%
Label	Stu min	20% 00% 10%	o max		dire mear	ı sua	min 20%	50%
mitm	0.0 0.0	0.0 0.0 0.0	0.0	675	54.0 0.0	0.0	0.0 0.0	0.0
normal	0.0 0.0	0.0 0.0 0.0	0.0	16445	57.0 0.0	0.0	0.0 0.0	0.0
		Tand Handam Law						,
	75% max	Fwd Header Ler count		an	std	min 25	5% 50%	75%
Label	10% 11022	Count	, mo		Dua	min 20	376 0076	1 0 /6
mitm	0.0 0.0	6754.0	78.7906	43 78.	922803	0.0	.0 136.0	160.0
normal	0.0 0.0	164457.0	79.0398	46 79.	159871	0.0	.0 136.0	160.0
	Desc	d Header Len						\
	max	count	mean		std m	nin 25	5% 50%	75%
Label	man	oouns	moun		204 1		270	1 0 / 0
mitm	192.0	6754.0	21.288126	57.54	18323 44	1.0 64	.0 176.0	176.0
normal	192.0	164457.0	21.004080	57.19	93933 64	1.0 64	.0 176.0	176.0
	E	d Dk+a/a						\
	max	d Pkts/s count	mean	st.d	min 25	5%	50%	75%
Label		-				.,	••	, ,

mitm normal	264.0 264.0			0.0 084742 0.0 0889838 0.0	0.0 3.77085 0.0 0.04167	
Label	max	Bwd Pkts/s	mea	n	std mi	n 25%
mitm normal	15.614265 96.677516	6754.0 164457.0				
Label	50%	%	75%	Pkt max	Len Min count mean	std min
mitm normal	9.511096 100.446989			7.142857 1.285714	6754.0 0.0 164457.0 0.0	
Label	25% 50%	75% max	kt Len Max count	mean	std min	25% 50%
mitm normal	0.0 0.0	0.0 0.0 0.0			35.021639 0.0 34.918514 0.0	
Label	75% max	Pkt Len M x co	ean unt mear	n std	min 25%	50%
mitm normal	70.0 72.0 68.0 72.0					.153846 .384615
Label	75%	max	Pkt Len Std count	mean	std m	\ in 25%
mitm normal	15.636364 15.636364	20.000000 15.818182	6754.0 164457.0	12.154557 12.197651		.0 0.0
Label	50%	75%		Pkt Len Var count	mean	std
mitm normal	22.905756 23.027297	24.371369 24.371369		6754.0 164457.0	295.403750 297.512394	
Label	min 25%	50%	75%	max	FIN Flag Cnt count	mean
mitm normal	0.0 0.0		593.963636 593.963636	773.090909 599.854545		
	std	min 25%	50% 75% max	SYN Flag C		\ std

						0.499852 0.499894	
			RST	Flag Cnt			\
	min 25%	50% 75%		•		l min 25%	·
Label							
mitm -		0.0 1.0					
normal	0.0 0.0	0.0 1.0	1.0	164457.0	0.0 0.0	0.0 0.0	0.0 0.0
	PSH I	Flag Cnt				ACK I	Flag Cnt \
		•	ean std	min 25%	50% 75%	max	•
Label							
						0.0	
normal	0.0	164457.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0	164457.0
					UF	G Flag Cnt	\
	mean	std	min 25	6 50% 75 kg		count	
Label							
		0.500037				6754.0	
normal	0.500106	0.500002	0.0 0.0	0 1.0 1.	.0 1.0	164457.0	0.0 0.0
			CWE	Flag Cour	n+		\
	min 25%	50% 75%				td min 25	5% 50% 75%
Label							
mitm	0.0 0.0	0.0 0.0	0.0	6754	.0 0.0 0	0.0 0.0 0	.0 0.0 0.0
normal	0.0 0.0	0.0 0.0	0.0	164457	.0 0.0 0	0.0 0.0 0	.0 0.0 0.0
	ECE :	7] <i>C</i> +				D	/II D-+:- \
		Flag Cnt	ean std	min 25%	50% 75%	, max	/Up Ratio \
Label	max	COUNTY III	oun bou	min 20%	00% 10%) man	oouno
	0.0	6754.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0	6754.0
normal	0.0	164457.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0	164457.0
					D.		,
	maan	c+d	min 25	/ 50% 75		t Size Avg	
Label	mean	std	IIIII 25,	, 50% / 6	o% max	Count	mean
	0.500444	0.500629	0.0 0.0	0 1.0 1.	.0 2.0	6754.0	8.603843
		0.500427				164457.0	
	3	÷ 0.E%	F 0 %	7 - 0/		l Seg Size <i>I</i>	•
Label	sta	min 25%	50%	75%	max	COL	ınt mean
Tabet							
mitm	8.603407	0.0 0.0	14.25	17.2 21.8	318182	6754	1.0 9.749585
		0.0 0.0					4.0 9.749585 7.0 9.749339

Bwd Seg Size Avg

T - 1 - 7		std	min	25%	50%	75%	max		C	ount		mean		
Label	0.75	E720	0 0	0 0	10 0	10 6	28.0		671	54 O	7 / 0	20042		
normal		3269					20.0				7.55			
потшат	9.15	3209	0.0	0.0	10.0	19.2	20.0		10440	51.0	7.50	00102		
									Fwd By	zts/b	Ανσ			\
		std	min	25%	50	% 75	5%	max	-		_	mean	std	`
Label		200		_070		,,	70			·	0 411 0	0 0		
	7.49	6550	0.0	0.0	12.37	5 14.	4 16.66	66667		67	54.0	0.0	0.0	
							6 16.66							
					F	wd Pkt	s/b Avg							\
	min	25%	50%	75%	max		count	mean	std	min	25%	50%	75%	
Label														
mitm							6754.0					0.0	0.0	
normal	0.0	0.0	0.0	0.0	0.0	1	64457.0	0.0	0.0	0.0	0.0	0.0	0.0	
		Fwd B		te Av	_	_		-0/		,	\			
	max			coun	t mean	std	min 25	5% 5C)% 75%	‰ ma	.X			
Label	0 0			0754				0 0	0 0 0		•			
mitm							0.0 0							
normal	0.0		16	4457.	0.0	0.0	0.0	.0 0.	0 0.0) 0.	0			
	Bwd B	wte/h	Δνσ						_		1_4 _ /1_	Λ		`
	Dwa D									KTJA P				
		-	_	mean	st.d	min 2	5% 50%	75%				_	mean	\
Label		-	_	mean	std	min 2	25% 50%	75%				count		\
Label mitm		С	ount						max		C	count	mean	`
Label mitm normal		67	_	0.0	0.0	0.0 0	25% 50% 0.0 0.0 0.0 0.0	0.0	max 0.0		67	count	mean 0.0	`
mitm		67	ount 54.0	0.0	0.0	0.0 0	0.0 0.0	0.0	max 0.0		67	count '54.0	mean 0.0	`
mitm		67	ount 54.0	0.0	0.0	0.0 0	0.0 0.0	0.0	0.0 0.0		67	count '54.0	mean 0.0	\
mitm	std	67 1644	ount 54.0 57.0	0.0	0.0	0.0 0 0.0 0 Bw	0.0 0.0	0.0 0.0 ate Av	0.0 0.0		67 1644	754.0 157.0	0.0 0.0	\
mitm		67 1644	ount 54.0 57.0	0.0	0.0	0.0 0 0.0 0 Bw	0.0 0.0 0.0 0.0 rd Blk Ra	0.0 0.0 ate Av	0.0 0.0		67 1644	754.0 157.0	0.0 0.0	\
mitm normal Label	std	67 1644 min	ount 54.0 57.0	0.0 0.0	0.0 0.0 75%	0.0 0 0.0 0 Bw	0.0 0.0 0.0 0.0 rd Blk Ra	0.0 0.0 ate Av	max 0.0 0.0 7g	ı st	67 1644 d mi	754.0 157.0	0.0 0.0	`
mitm normal Label mitm	std 0.0	67 1644 min 0.0	ount 54.0 57.0 25% 0.0	0.0 0.0 50%	0.0 0.0 75% 0.0	0.0 0 0.0 0 Bw max	0.0 0.0 0.0 0.0 rd Blk Ra	0.0 0.0 ate Av cour	max 0.0 0.0 7g at mean 0 0.0	n st	67 1644 d mi	754.0 157.0 n 25	0.0 0.0 0.0	`
mitm normal Label mitm	std 0.0	67 1644 min 0.0	ount 54.0 57.0 25% 0.0 0.0	0.0 0.0 50% 0.0 0.0	0.0 0.0 75% 0.0 0.0	0.0 0 0.0 0 Bw max 0.0	0.0 0.0 0.0 0.0 rd Blk Ra	0.0 0.0 ate Av cour	max 0.0 0.0 7g at mean 0 0.0	n st	67 1644 d mi	754.0 157.0 n 25	0.0 0.0 0.0	
mitm normal Label mitm	std 0.0 0.0	67 1644 min 0.0 0.0	ount 54.0 57.0 25% 0.0 0.0	0.0 0.0 50% 0.0 0.0 Subfl	0.0 0.0 75% 0.0 0.0	0.0 0 0.0 0 Bw max 0.0 0.0	0.0 0.0 0.0 0.0 rd Blk Ra	0.0 0.0 ate Av cour 6754.	max 0.0 0.0 7g at mear 0 0.0	n st) 0.	67 1644 d mi 0 0. 0 0.	754.0 157.0 .n 25	0.0 0.0 \ \ \ %	
mitm normal Label mitm normal	std 0.0 0.0	67 1644 min 0.0	ount 54.0 57.0 25% 0.0 0.0	0.0 0.0 50% 0.0 0.0 Subfl	0.0 0.0 75% 0.0 0.0	0.0 0 0.0 0 Bw max 0.0 0.0	0.0 0.0 0.0 0.0 rd Blk Ra	0.0 0.0 ate Av cour 6754.	max 0.0 0.0 7g at mear 0 0.0	n st) 0.	67 1644 d mi	754.0 157.0 .n 25	0.0 0.0 \ \ \ %	
mitm normal Label mitm normal	std 0.0 0.0	67 1644 min 0.0 0.0	ount 54.0 57.0 25% 0.0 0.0	0.0 0.0 50% 0.0 0.0 Subfl	0.0 0.0 75% 0.0 0.0	0.0 0 0.0 0 Bw max 0.0 0.0	0.0 0.0 0.0 0.0 rd Blk Ra	0.0 0.0 ate Av cour 6754. 64457.	max 0.0 0.0 rg at mean 0 0.0 0 0.0	n st) 0.) 0.	67 1644 d mi 0 0. 0 0.	754.0 257.0 257.0 0 0.0	0.0 0.0 0.0 %	
mitm normal Label mitm normal	std 0.0 0.0	67 1644 min 0.0 0.0	ount 54.0 57.0 25% 0.0 0.0 max 0.0	0.0 0.0 50% 0.0 0.0 Subfl	0.0 0.0 75% 0.0 0.0 ow Fwd	0.0 0 0.0 0 Bw max 0.0 0.0 Pkts count	0.0 0.0 0.0 0.0 rd Blk Ra 16 mea 2.44906	0.0 0.0 ate Av cour 6754. 64457.	max 0.0 0.0 7g 1t mean 0 0.0 0 0.0 457426	n st 0 0. 0 0.	67 1644 d mi 0 0. 0 0.	754.0 257.0 257.0 0 0.0 0 0.0	0.0 0.0 0.0 \ \ %	
mitm normal Label mitm normal	std 0.0 0.0	67 1644 min 0.0 0.0	ount 54.0 57.0 25% 0.0 0.0 max 0.0	0.0 0.0 50% 0.0 0.0 Subfl	0.0 0.0 75% 0.0 0.0 ow Fwd	0.0 0 0.0 0 Bw max 0.0 0.0 Pkts count	0.0 0.0 0.0 0.0 rd Blk Ra	0.0 0.0 ate Av cour 6754. 64457.	max 0.0 0.0 7g 1t mean 0 0.0 0 0.0 457426	n st 0 0. 0 0.	67 1644 d mi 0 0. 0 0.	754.0 257.0 257.0 0 0.0	0.0 0.0 0.0 \ \ %	
mitm normal Label mitm normal	std 0.0 0.0	67 1644 min 0.0 0.0 75% 0.0	ount 54.0 57.0 25% 0.0 0.0 max 0.0 0.0	0.0 0.0 50% 0.0 0.0 Subfl	0.0 0.0 75% 0.0 0.0 ow Fwd	0.0 0 0.0 0 Bw max 0.0 0.0 Pkts count	0.0 0.0 0.0 0.0 rd Blk Ra 16 mea 2.44906	0.0 0.0 ate Av cour 6754. 64457.	max 0.0 0.0 7g 1t mean 0 0.0 0 0.0 457426	n st 0 0. 0 0.	67 1644 d mi 0 0. 0 0.	754.0 257.0 257.0 0 0.0 0 0.0	0.0 0.0 0.0 \ \ %	
mitm normal Label mitm normal	std 0.0 0.0 50% 0.0	67 1644 min 0.0 0.0 75% 0.0 0.0	ount 54.0 57.0 25% 0.0 0.0 max 0.0 0.0 Subfl	0.0 0.0 50% 0.0 0.0 Subfl	0.0 0.0 75% 0.0 0.0 ow Fwd 6 164	0.0 0 0.0 0 Bw max 0.0 0.0 Pkts count 754.0	0.0 0.0 0.0 0.0 rd Blk Ra 16 mea 2.44906 2.45980	0.0 0.0 ate Av cour 6754. 64457. an	max 0.0 0.0 7g 1t mean 0 0.0 0 0.0 457426 466897	n st 0 0. 0 0. d mi 6 0. 7 0.	67 1644 d mi 0 0. 0 0. n 25 0 0. 0 0.	754.0 257.0 257.0 0 0.0 0 0.0	0.0 0.0 0.0 \ %	
mitm normal Label mitm normal Label mitm normal	std 0.0 0.0 50% 0.0	67 1644 min 0.0 0.0 75% 0.0	ount 54.0 57.0 25% 0.0 0.0 max 0.0 0.0 Subfl	0.0 0.0 50% 0.0 0.0 Subfl	0.0 0.0 75% 0.0 0.0 ow Fwd	0.0 0 0.0 0 Bw max 0.0 0.0 Pkts count 754.0	0.0 0.0 0.0 0.0 rd Blk Ra 16 mea 2.44906	0.0 0.0 ate Av cour 6754. 64457. an	max 0.0 0.0 7g 1t mean 0 0.0 0 0.0 457426 466897	n st 0 0. 0 0. d mi 6 0. 7 0.	67 1644 d mi 0 0. 0 0. n 25 0 0. 0 0.	754.0 257.0 257.0 0 0.0 0 0.0	0.0 0.0 0.0 \ \ %	
mitm normal Label mitm normal Label mitm normal	std 0.0 0.0 50% 0.0 0.0	67 1644 min 0.0 0.0 75% 0.0 0.0	ount 54.0 57.0 25% 0.0 0.0 max 0.0 0.0 Subfl	0.0 0.0 50% 0.0 0.0 Subfl	0.0 0.0 75% 0.0 0.0 ow Fwd 164 d Byts count	0.0 0 0.0 0 Bw max 0.0 0.0 Pkts count 754.0	0.0 0.0 0.0 0.0 rd Blk Ra 16 mea 2.44906 2.45980	0.0 0.0 ate Av cour 6754. 64457.	max 0.0 0.0 7g 1t mean 0 0.0 5to 457426 466897	n st 0 0. 0 0. d mi 6 0. 7 0.	67 1644 d mi 0 0. 0 0. n 25 0 0. 0 0.	754.0 257.0 257.0 250.0 37.0 38.50 4.0 4.0	mean 0.0 0.0 % 0 0 75%	\
mitm normal Label mitm normal Label mitm normal	std 0.0 0.0 50% 0.0 0.0	67 1644 min 0.0 0.0 75% 0.0 0.0	ount 54.0 57.0 25% 0.0 0.0 max 0.0 0.0 Subfl	0.0 0.0 50% 0.0 0.0 Subfl	0.0 0.0 75% 0.0 0.0 ow Fwd 6164 d Byts count	0.0 0 0.0 0 Bw max 0.0 0.0 Pkts count 754.0 457.0	0.0 0.0 0.0 0.0 rd Blk Ra 16 mea 2.44906 2.45980	0.0 0.0 ate Av cour 6754. 64457. an 67 2. 04 2.	max 0.0 0.0 7g 1t mean 0 0.0 0 0.0 457426 466897 std n	n st 0 0. 0 0. 1 mi 6 0. 7 0. nin	67 1644 d mi 0 0. 0 0. 0 0. 25% 0.0	754.0 257.0 257.0 0 0.0 0 0.0	mean 0.0 0.0 '% 0 75% 98.0	\

		Sub	flow	Bwd Pl	kts										\	
	ma	X		COI	unt	me	an	s.	td m	in 2	5%	50%	75%	√ max		
Label	160	^		675	4 0	2 5521	E / 1	ECOC	00 1	0 0	^	F 0	F (
mitm normal	168. 100.			6754 16445		3.5531 3.5415		.5696: .5538:				5.0 5.0	5.0 5.0			
HOTMAT	100.	O		10445	1.0	3.0410	15 1	. 0000	19 2	.0 2	.0	5.0	5.0	0.0		
	Subfl	ow Bwo	d Byt	s											\	
			coun	t	me	an	s ⁻	td m	in 2	5%	50%	75	%	max		
Label													_			
mitm			6754.			74 38	.75628				2.0 2.0	72. 78.		100.0		
normal		102	1457.	0 30	.4616	000 30	. / 5020	00 0	.0 0	.0 7.	2.0	10.	0 .	100.0		
	Init	Fwd W	in By	ts							In	it B	wd V	√in By	ts '	\
			cou	nt mea	an s	td mi	n 259	% 50°	% 75	% ma:	X			cou	nt	
Label																
mitm						0.0 -1.								6754		
normal		1,	04457	.0 -1	.0 0	0.0 -1.	0 -1.0	0 -1.0	0 -1.	0 -1.	U			164457	.0	
]	Fwd	Act	Data	a Pkts	\	
		mean		std	mi	n 25	% 50	0% .	75%	max				count		
Label																
mitm		96062		94657						85.0				3754.0		
normal	83.9	18684	0.9	96691	83.	0 83.	0 83	.0 8	5.0	85.0			104	1457.0		
									F	wd Se	g Si	ze M	in		\	
	:	mean		std	min	25%	50%	75% ı	max			cou	nt n	nean		
Label																
mitm	1.00			0740					3.0			6754		0.0		
normal	1.00	0213	1.00	0003	0.0	0.0	2.0	2.0	2.0		10	4457	.0	0.0		
						A	ctive	Mean							\	
	std	min	25%	50%	75%	max	•	count		mean		s	td	min		
Label																
mitm		0.0	0.0				6					5498		0.0		
normal	0.0	0.0	0.0	0.0	0.0	0.0	1044	457.0	0.0	03867	0.	2011	35	0.0		
					Acti	ve Std									\	
	25%	50%	75%	max		count	mean	std	min	25%	50	% 7	5%	max		
Label																
mitm		0.0				6754.0			0.0			0 0				
normal	0.0	0.0	0.0	36.0	16	4457.0	0.0	0.0	0.0	0.0	0.	υ 0	.0	0.0		
	Activ	e Max										Ac	tive	e Min	\	
		count		mean		std	min	25%	50%	75%	ma			count	,	
Label																
mitm _		754.0		08884		49823		0.0	0.0	0.0		0		754.0		
normal	164	457.0	0.0	03867	0.2	87735	0.0	0.0	0.0	0.0	36.	0	1644	157.0		

```
mean
                                 min
                                       25%
                                            50%
                                                 75%
                                                       max
                                                               count
                                                                              mean
     Label
     mitm
              0.008884
                        0.549823
                                  0.0
                                       0.0
                                            0.0
                                                 0.0
                                                      41.0
                                                              6754.0
                                                                      25647.077584
                                       0.0
                                                 0.0
                                                      36.0
              0.003867
                        0.287735
                                  0.0
                                           0.0
                                                            164457.0
                                                                      20526.033231
     normal
                                                             Idle Std
                                 25%
                                      50%
                                           75%
                       std
                           {\tt min}
                                                        max
                                                                count mean
                                                                            std
     Label
     mitm
              1.503937e+06
                                           0.0
                                                 98355743.0
                                                               6754.0
                            0.0
                                0.0
                                      0.0
                                                                       0.0
     normal
              1.423597e+06
                            0.0
                                0.0
                                      0.0
                                          0.0
                                               117440559.0
                                                             164457.0
                                       Idle Max
                   25%
                        50%
                             75%
                                          count
              min
                                                                        std
                                                                            min
                                  max
                                                         mean
     Label
                                  0.0
                                                 25647.077584 1.503937e+06 0.0
     mitm
              0.0
                   0.0
                        0.0
                             0.0
                                         6754.0
              0.0
                   0.0
                        0.0
                             0.0 0.0
                                      164457.0 20526.033231 1.423597e+06 0.0
     normal
                                          Idle Min
              25%
                   50%
                        75%
                                     max
                                             count
                                                            mean
                                                                           std min
     Label
     mitm
                   0.0
                        0.0
                              98355743.0
                                            6754.0 25647.077584 1.503937e+06 0.0
              0.0
              0.0
                   0.0
                             117440559.0
                                         164457.0 20526.033231 1.423597e+06 0.0
     normal
                       0.0
              25%
                   50%
                       75%
                                     max
     Label
      mitm
              0.0
                   0.0
                        0.0
                              98355743.0
              0.0
                  0.0
                       0.0
      normal
                             117440559.0
[17]: fw_36plc['Label'].unique()
[17]: array(['mitm'], dtype=object)
[18]: fw_36plc['Label'] = 'mitm_36plc'
[19]: # Drop unnecessary columns
      cols_to_drop = ['Flow ID', 'Src IP', 'Src Port', 'Dst IP', 'Dst Port', '
       #beniqn.drop(columns=cols_to_drop, errors='ignore', inplace=True)
      scapy_modify.drop(columns=cols_to_drop, errors='ignore', inplace=True)
      fw_36plc.drop(columns=cols_to_drop,errors='ignore', inplace=True)
[20]: # Merge
      df = pd.concat([scapy_modify,fw_36plc], ignore_index=True)
```

Idle Mean

[21]: df.groupby("Label").describe() [21]: Protocol Flow Duration \ count mean std min 25% 50% 75% max count Label 6.0 6.0 6.0 6.0 mitm 6754.0 6.0 0.0 6.0 6754.0 6.0 mitm_36plc 188383.0 6.0 0.0 6.0 6.0 6.0 6.0 188383.0 164457.0 6.0 0.0 6.0 6.0 6.0 6.0 6.0 normal 164457.0 25% 50% std min 75% mean Label 434630.275540 1.566391e+06 14.0 35.0 616202.5 792774.25 mitm mitm_36plc 65592.658149 1.536137e+06 5.0 11.0 60558.0 78157.50 58148.334805 73380.00 normal 1.424615e+06 7.0 14.0 57859.0 Tot Fwd Pkts 25% 75% max count meanstd min 50% Label 2.449067 99088176.0 6754.0 2.457426 0.0 0.0 4.0 mitm 119999986.0 2.456639 2.464104 0.0 0.0 4.0 5.0 mitm_36plc 188383.0 164457.0 2.459804 2.466897 0.0 0.0 4.0 5.0 normal 117511126.0 Tot Bwd Pkts maxcount std min 25% 50% 75% max mean Label mitm 6.0 6754.0 3.553154 1.569620 1.0 2.0 5.0 5.0 8.0 mitm_36plc 6.0 188383.0 3.545108 1.558325 2.0 2.0 5.0 5.0 8.0 6.0 2.0 2.0 normal 164457.0 3.541515 1.553819 5.0 5.0 TotLen Fwd Pkts count mean std min 25% 50% 75% max Label 47.787385 72.0 98.0 mitm 6754.0 48.099579 0.0 0.0 168.0 mitm_36plc 188383.0 47.905904 48.129617 0.0 0.0 72.0 96.0 100.0 normal 47.981515 48.193465 0.0 0.0 72.0 96.0 100.0 164457.0 TotLen Bwd Pkts count min 25% 50% 75% mean std maxLabel 38.269174 38.660947 0.0 0.0 72.0 72.0 100.0 mitm 6754.0 72.0 mitm_36plc 188383.0 38.543924 38.853495 0.0 0.0 78.0 100.0 normal 164457.0 38.461665 38.756286 0.0 0.0 72.0 78.0 100.0 Fwd Pkt Len Max 25% 50% 75% count mean std min max

Label

```
mitm
                   6754.0
                           33.752147
                                      34.166059
                                                 0.0
                                                      0.0
                                                          44.0 70.0 72.0
                                                      0.0
                                                          44.0
                                                                68.0 72.0
mitm_36plc
                 188383.0 33.901817
                                      34.226893
                                                 0.0
normal
                 164457.0
                           33.978535
                                      34.284204
                                                 0.0
                                                      0.0 44.0
                                                                68.0 72.0
          Fwd Pkt Len Min
                                          25%
                                               50%
                                                   75%
                    count mean
                               std min
Label
mitm
                   6754.0
                           0.0
                                0.0
                                     0.0
                                          0.0
                                               0.0
                                                    0.0
                                                         0.0
mitm 36plc
                 188383.0
                                0.0
                                     0.0
                                          0.0
                                               0.0
                                                    0.0
                                                        0.0
                           0.0
normal
                 164457.0
                           0.0
                                0.0 0.0
                                          0.0
                                               0.0
                                                    0.0
                                                        0.0
          Fwd Pkt Len Mean
                     count
                                mean
                                           std min
                                                    25%
                                                          50%
                                                                75%
                                                                      max
Label
                    6754.0 9.749585 9.755739
                                                0.0
                                                    0.0
                                                                     28.0
mitm
                                                         18.0
                                                               19.6
                                      9.750116 0.0 0.0
mitm_36plc
                  188383.0 9.746797
                                                         18.0 19.2 25.0
                                      9.753269 0.0 0.0
                                                         18.0 19.2 20.0
normal
                  164457.0 9.749339
          Fwd Pkt Len Std
                                                      25%
                                                                 50%
                    count
                                            std min
                                mean
Label
mitm
                   6754.0 14.920295 15.028194
                                                 0.0
                                                      0.0
                                                          21.786846
mitm_36plc
                 188383.0 14.965210
                                      15.048824
                                                 0.0
                                                      0.0
                                                          21.786846
normal
                 164457.0
                           14.990621
                                      15.069873
                                                 0.0
                                                      0.0 21.786846
                                Bwd Pkt Len Max
                                          count
                 75%
                            max
                                                      mean
                                                                  std min
Label
mitm
            30.672463
                      34.292856
                                         6754.0
                                                 24.265028
                                                            24.886134
                                                                      0.0
           29.852973 34.000000
                                       188383.0
                                                 24.539836
                                                            25.033469
mitm_36plc
                                                                      0.0
normal
            29.852973 31.496031
                                       164457.0 24.458685
                                                            24.926832
                                                                      0.0
                                 Bwd Pkt Len Min
            25%
                 50%
                       75%
                             max
                                           count mean
                                                       std
                                                           min
                                                                25%
                                                                     50%
Label
mitm
            0.0 44.0
                      44.0
                            72.0
                                          6754.0
                                                 0.0
                                                       0.0
                                                           0.0
                                                                0.0 0.0
           0.0 44.0
                      50.0 72.0
                                        188383.0
                                                 0.0
                                                      0.0 0.0 0.0 0.0
mitm_36plc
normal
            0.0 44.0
                      50.0 72.0
                                        164457.0 0.0 0.0 0.0 0.0 0.0
                    Bwd Pkt Len Mean
                                                                           \
           75% max
                               count
                                          mean
                                                     std min
                                                              25%
                                                                      50%
Label
mitm
           0.0 0.0
                              6754.0 7.480942 7.496550
                                                         0.0
                                                              0.0
                                                                   12.375
mitm_36plc
           0.0 0.0
                            188383.0 7.563971 7.577124
                                                         0.0
                                                              0.0
                                                                   12.000
normal
            0.0 0.0
                            164457.0 7.558702 7.572162
                                                         0.0 0.0
                                                                   12.000
                           Bwd Pkt Len Std
                                                                           \
```

	75%	max		count	mea	an sto	l min	25%
Label mitm mitm_36plc normal	15.6 16.	666667 666667 666667	188	754.0 383.0 457.0	11.01265 11.12734 11.10255	14 11.233186	0.0	0.0 0.0 0.0
				F	low Byts,	/s	\	
Label	50%	7	5%	max	cour		an	
mitm mitm_36plc normal	20.51341 20.51341 20.51341	20.5134 22.7332 22.7332	36 29.33	0303	6754 188383 164457	.0 1094.9548	81	
	s	td min	25%	50%		75%	max	\
Label mitm mitm_36plc normal	107.7243 1109.8160 1180.2433	59 0.0	0.0 2.0	92790 07809 03155	216.632 2210.650 2355.486	760 2991.74	6905	
	Flow Pkts/				-4.3		٥٦	\
Label mitm mitm_36plc normal	6754. 188383. 164457.	0 35418 0 90833	.995794	39916.6 99095.4 78249.6	427321 (0.100000 127	25 2.61393 7.94677 6.27877	31 74
						Flow IAT Mea	ın \	
Label	509	%	75%		max	cour	ıt	
mitm mitm_36plc normal	16.23117 165.13094 172.96250	9 18181	2.857143 8.181818 7.142857	400000	7.142857 0.000000 4.285714	6754 188383 164457	0	
	m	ean	st	d mi	n 25%	50%	\	
Label mitm mitm_36plc normal	47810.307- 6776.849- 6053.155-	408 144 563 139	692.16803 659.18125 522.08267	5 14.0 6 5.0	0 35.0 0 11.0	69502.500000 6728.666667 6424.000000)	
				Flow 1	IAT Std		\	
Label		75%	max		count	mear	l	
mitm mitm_36plc normal	88088.583 8684.166 8153.222	667 1.0	08016e+06 90909e+07 68283e+07	18	6754.0 88383.0 64457.0	61929.003762 15207.344502 13498.581455	?	

								\		
		std m	in 25%	'	5	50%		75%		
Label										
mitm	455455.01	6393 0	.0 0.0	7582	3.0850)52 10	05804.078	3147		
mitm_36plc	462689.88	5739 0	.0 0.0	1185	9.9894	197 1	14094.021	.412		
normal	429158.49	3273 0	.0 0.0	1162	7.9648	369 1	13719.697	409		
		Flo	w IAT M	ſax						\
	1	nax	cou	ınt		mean		std	min	
Label										
mitm	2.963342e		6754			391146			14.0	
mitm_36plc	3.615716e		188383		9186.5		1.53470		5.0	
normal	3.540754e	+07	164457	7.0 4	3585.3	339639	1.42345	8e+06	7.0	
						E.I	Low IAT N	lin		\
	25%	50%	7	75%		max	COU COU		mean	n \
Label	_070	0070	•	- 70						-
mitm	35.0 194	066.0	276949.	75 9	835574	13.0	6754	.0 63	.70861	7
mitm_36plc		497.0	44321.		992702		188383		.34671	
normal		986.0	43238.	00 11	744055	59.0	164457	.0 16	.78480	7
							Fwc	I TAI I	ot \	
	s.	td mi	n 25%	50%	75%	,	max	cou	nt	
Label										
mitm	1664.4191						501.0	6754		
mitm_36plc	5.4971						106.0	188383		
normal	9.1518	35 4.	0 11.0) 14.0	22.0) 20	064.0	164457	.0	
									\	
	1	nean		std	min	25%	50%		75%	
Label						,,	2 2 70		70	
mitm	314562.58	7060 3	15999.4	120297	0.0	0.0	170988.5	62855	5.0	
mitm_36plc	34614.07	2215	35220.8	37825	0.0	0.0	51083.0	6736	1.0	
normal	34062.66	5639	34647.2	273340	0.0	0.0	50543.0	6631	7.0	
		Fwd IAT							0.5%	\
T - 1 - 1	max		count		mean	1	sto	l min	25%	
Label	776510 0	c	754 0	01054	COOFOC	0045	7 004205		0 0	
mitm	776518.0			81354.			57.804395		0.0	
mitm_36plc			383.0				52.045093		0.0	
normal	156975.0	104	457.0	0121.	140200	008	98.843536	0.0	0.0	
					Fw	d IAT	Std		\	
	50%		75%	:	max		ount	m	ean	
Label	70									
mitm	118766.25	15896	8.375	252569	.00	675	54.0 742	244.508	187	

mitm_36plc normal	13306.00 13176.00	17228 . 16922 .		57305.0 39243.7			0548.331 0256.294			
	sto	d min	25%		50%		\ 75%			
Label										
mitm mitm_36plc	75455.695403 10815.44274		0.0	65767.3 15065.1		151067.29 19836.70				
normal	10501.46060		0.0	14713.7		19285.95				
			T.A							,
	ma	Fwd ax	IAT M		me	an	std	min	25%	\
Label			000				204		_0,0	
mitm	201558.9044		6754		264.0253		0.636886			
mitm_36plc normal	99892.93623 68549.94493		188383 164457		355.5251 379.3256		9.986474 3.684397			
HOTMAL	00049.9449.	.5	104437	.0 230	719.3230	29 2551	3.004391	0.0	0.0	
				F	wd IAT	Min		\		
Ishal	50%	75	5%	max	CO.	unt	mean			
Label mitm	204687.0 30	7223.2	25 43	8777.0	675	4.0 6640	.931744			
mitm_36plc		14366.0		6711.0	18838		.281368			
normal	37016.0	13284.0	00 14	1872.0	16445	7.0 1221	.682902			
							Rwd T	ΔТ То-	+ \	
	sto	d min	25%	50%	75'	% m	Bwd I	AT To		
Label							ax	coun	t	
mitm	18928.24143	1 0.0	0.0	1958.0	6095.2	5 135708	.0	coun [.] 6754.	t 0	
mitm mitm_36plc	18928.24143 1417.51757	0.0	0.0	1958.0 1204.0	6095.2 2085.0	5 135708 0 16531	.0 .0 18	coun 6754.0 8383.0	0 0	
mitm	18928.24143	0.0	0.0	1958.0	6095.2	5 135708 0 16531	.0 .0 18	coun [.] 6754.	0 0	
mitm mitm_36plc	18928.24143 1417.51757	0.0	0.0	1958.0 1204.0 1239.0	6095.2 2085.0 2082.0	5 135708 0 16531 0 19406	.0 .0 18 .0 16	coun 6754.(8383.(4457.(0 0	
mitm mitm_36plc normal	18928.24143 1417.51757	1 0.0 9 0.0 2 0.0	0.0	1958.0 1204.0	6095.2 2085.0 2082.0	5 135708 0 16531	.0 .0 18 .0 16	coun 6754.0 8383.0	0 0	
mitm mitm_36plc	18928.241434 1417.517579 1431.21074	1 0.0 9 0.0 2 0.0	0.0	1958.0 1204.0 1239.0 std mi	6095.2 2085.0 2082.0	5 135708 0 16531 0 19406 50	.0 .0 18 .0 16	coun 6754. 8383. 4457. 75%	0 0	
mitm mitm_36plc normal Label	18928.241434 1417.517579 1431.210749 mea	1 0.0 9 0.0 2 0.0 an	0.0 0.0 0.0	1958.0 1204.0 1239.0 std mi	6095.2 2085.0 2082.0 .n 25%	5 135708 0 16531 0 19406	ax .0 .0 .0 .18 .0 16 % 0 78599	coun 6754.4 8383.4 4457.4 75%	0 0	
mitm mitm_36plc normal Label mitm	18928.241434 1417.517579 1431.210742 mea	1 0.0 9 0.0 2 0.0 an 74 1.5	0.0 0.0 0.0	1958.0 1204.0 1239.0 std mi	6095.2 2085.0 2082.0 2082.0 2082.0 35.0 0 35.0	5 135708 0 16531 0 19406 50 609929. 56631.	ax .0 .0 .18 .0 16 % 0 78599 0 7212	coun 6754. 8383. 4457. 75% 2.25 9.00	0 0	
mitm mitm_36plc normal Label mitm mitm_36plc	18928.241434 1417.517579 1431.210749 mea 431217.40657 62640.28787	1 0.0 9 0.0 2 0.0 an 74 1.5 71 1.5	0.0 0.0 0.0 5665578 536110	1958.0 1204.0 1239.0 std mi se+06 0.0 e+06 5.0	6095.2 2085.0 2082.0 2082.0 2082.0 35.0 0 35.0	5 135708 0 16531 0 19406 50 609929. 56631.	ax .0 .0 .18 .0 16 % 0 78599 0 7212	coun 6754. 8383. 4457. 75% 2.25 9.00	0 0	\
mitm mitm_36plc normal Label mitm mitm_36plc	18928.241434 1417.517579 1431.210749 mea 431217.40657 62640.28787	1 0.0 9 0.0 2 0.0 an 74 1.5	0.0 0.0 0.0 5665578 536110	1958.0 1204.0 1239.0 std mi se+06 0. e+06 5.	6095.2 2085.0 2082.0 2082.0 2082.0 35.0 0 35.0	5 135708 0 16531 0 19406 50 609929. 56631. 54144.	ax .0 .0 .18 .0 16 % 0 78599 0 7212	coun 6754. 8383. 4457. 75% 2.25 9.00	0 0	\
mitm mitm_36plc normal Label mitm mitm_36plc normal	18928.241434 1417.517579 1431.210749 mea 431217.40657 62640.28787 55162.79799	1 0.0 9 0.0 2 0.0 an 74 1.5 71 1.5	0.0 0.0 0.0 0.0 5665578 536110 124580 AT Mea coun	1958.0 1204.0 1239.0 std mi se+06 0.0 e+06 5.0 e+06 7.0	6095.2 2085.0 2082.0 n 25% 0 35.0 0 11.0 0 14.0	5 135708 0 16531 0 19406 50 609929. 56631. 54144.	ax .0 .0 .18 .0 16 % 0 78599 0 7212 0 6706	coun 6754.4 8383.4 4457.6 75% 2.25 9.00 7.00	t 0 0 0 0	\
mitm mitm_36plc normal Label mitm mitm_36plc normal Label mitm	18928.241434 1417.517575 1431.210745 mea 431217.4065 62640.2878 55162.79795 max 99088176.0	1 0.0 9 0.0 2 0.0 an 74 1.5 17 1.4 Bwd I	0.0 0.0 0.0 0.0 565578 536110 124580 AT Mea coun	1958.0 1204.0 1239.0 std mi se+06 0. e+06 5. e+06 7.	6095.2 2085.0 2082.0 2082.0 35.0 0 35.0 0 11.0 0 14.0 mea:	5 135708 0 16531 0 19406 50 609929. 56631. 54144.	ax .0 .0 .18 .0 16 % 0 78599 0 7212 0 6706 std .336597	coun 6754. 8383. 4457. 75% 2.25 9.00 7.00 min 0.0	25% 35.0	\
mitm mitm_36plc normal Label mitm mitm_36plc normal	18928.241434 1417.517579 1431.210749 mea 431217.40657 62640.28787 55162.79799	1 0.0 9 0.0 2 0.0 An 74 1.5 71 1.5 17 1.4	0.0 0.0 0.0 0.0 5665578 536110 124580 AT Mea coun	1958.0 1204.0 1239.0 std mi se+06 0. e+06 5. e+06 7.	6095.2 2085.0 2082.0 n 25% 0 35.0 0 11.0 0 14.0	5 135708 0 16531 0 19406 50 609929. 56631. 54144.	ax .0 .0 .18 .0 16 % 0 78599 0 7212 0 6706	coun 6754.4 8383.4 4457.6 75% 2.25 9.00 7.00	t 0 0 0 0	\
mitm mitm_36plc normal Label mitm mitm_36plc normal Label mitm mitm_36plc	18928.241434 1417.517579 1431.210742 mea 431217.40657 62640.28787 55162.79799 max 99088176.0 119999986.0	1 0.0 9 0.0 2 0.0 An 74 1.5 71 1.5 17 1.4	0.0 0.0 0.0 0.0 565578 536110 424580 AT Mea coun 6754.	1958.0 1204.0 1239.0 std mi se+06 0. e+06 5. e+06 7.	6095.2 2085.0 2082.0 2082.0 2082.0 35.0 0 11.0 0 14.0 mean 95.40574 19.30337	5 135708 0 16531 0 19406 50 609929. 56631. 54144. n 7 237557 0 219509 7 203580	ax .0 .0 .18 .0 16 % 0 78599 0 7212 0 6706 std .336597 .307229 .924270	coun 6754.8 8383.4 4457.6 75% 2.25 9.00 7.00 min 0.0 5.0	25% 35.0	\
mitm mitm_36plc normal Label mitm mitm_36plc normal Label mitm mitm_36plc	18928.241434 1417.517579 1431.210742 mea 431217.40657 62640.28787 55162.79799 max 99088176.0 119999986.0	1 0.0 9 0.0 2 0.0 An 74 1.5 71 1.5 17 1.4	0.0 0.0 0.0 0.0 565578 536110 424580 AT Mea coun 6754.	1958.0 1204.0 1239.0 std mi se+06 0. e+06 5. e+06 7.	6095.2 2085.0 2082.0 2082.0 2082.0 35.0 0 11.0 0 14.0 mean 95.40574 19.30337	5 135708 0 16531 0 19406 50 609929. 56631. 54144.	ax .0 .0 .18 .0 .16 % 0 78599 0 7212 0 6706 std .336597 .307229 .924270	coun 6754.8 8383.4 4457.6 75% 2.25 9.00 7.00 min 0.0 5.0	25% 35.0 11.0	\

Label mitm mitm_36plc normal	12548.0 17757.5000 1					1.415545e+07 6754 1.714286e+07 188383 1.678730e+07 164457					3.0 19601.336573				
			std m	in 25	%		50%			75%			max	•	
Label															
mitm		92.745		.0 0.		030.16			3.563			2901			
mitm_36plc		79.910		.0 0.		100.01			1.943			32356			
normal	5379	56.338	3481 0	.0 0.	0 143	333.89	96201	1876	1.503	636	4.43	88392	e+07		
	Bwd I	AT Max	:										\		
		count	;	m	ean		st	d mi	n 2	25%		50%			
Label															
mitm		6754.0	1736	16.759	994 :	1.5088	31e+0	6 0.	0 35	.0	21307	0.0			
mitm_36plc	18	8383.0	494	05.281	543	1.5347	'04e+0	6 5.	0 11	.0	3792	21.0			
normal	16	4457.0	437	94.498	726	1.4234	£59e+0	6 7.	0 14	. 0	3747	1.0			
					Rwd 7	IAT Mi	n						\		
		75%		max		cour			mean	L		st	d `		
Label		. 070				0 0 012			0 0	-			-		
mitm	2939	05.25	9835	5743.0		6754.	0 38	636.8	16849	43	667.1	1406	4		
mitm_36plc															
normal							0 1	716.6	52025		087.7				
							_	1.50							
	min	25%	50%		75%			wd PS		_	000	a+d	min	\	
Label	min	25%	50%		15%		max		Cou	nt m	ean	std	min		
mitm	0.0	35.0	105.5	8120	5 25	15145	Μ		6754	0	0.0	0.0	0.0		
mitm_36plc	5.0	11.0	65.0		1.00	1488		1	88383			0.0	0.0		
normal	7.0	14.0	103.0		2.00	1384			64457		0.0	0.0	0.0		
normar		11.0	100.0	010	2.00	1001		_	01101	••	•••	0.0	0.0		
				Bwd	PSH I	Flags							\		
	25%	50%	75% m	ax	(count	mean	std	min	25%	50%	75	%		
Label															
mitm	0.0	0.0	0.0 0	.0	67	754.0	0.0	0.0	0.0	0.0	0.0	0.	0		
mitm_36plc	0.0	0.0	0.0 0	.0	1883	383.0	0.0	0.0	0.0	0.0	0.0	0.	0		
normal	0.0	0.0	0.0 0	.0	1644	157.0	0.0	0.0	0.0	0.0	0.0	0.	0		
		- 1 11	va ===								,				
		rwa Uh	G Flag		4-4		05%	E0%	75%	m =	\				
Label	max		coun	t mean	std	min	25%	50%	75%	max					
mitm	0.0		6754.	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
	0.0	1	.88383			0.0	0.0	0.0	0.0	0.0					
mitm_36plc normal	0.0		.64457.			0.0	0.0	0.0	0.0	0.0					
HOTHIGT	0.0	1	.04401.	0.0	0.0	0.0	0.0	0.0	0.0	0.0					

	Bwd URG Fla	gs						F	wd Head	er Len	\
	cou	nt mean	std	min	25%	50%	75%	max		count	
Label mitm	6754	0 0.0	0.0	0.0	0.0	0.0	0.0	0.0		3754.0	
mitm_36plc	188383	0.0	0.0	0.0			0.0		3734.0		
normal	164457		0.0	0.0	0.0			0.0		4457.0	
									\		
T - 1 - 7	mean	S.	td m	in 2	5%	50%	75	% m	ax		
Label mitm	78.790643	78.9228	03 0	.0 0	.0	136.0	160.	0 192	0		
mitm_36plc	78.965214	79.0890				136.0					
normal	79.039846	79.1598				136.0					
	Bwd Header	Len				_		04	04		\
I a b a l	co	unt	me	an		std	min	25%	50%	75%	
Label mitm	675	4.0 121	.2881	26 5'	7 54	8323	44.0	64.0	176.0	176.0	
mitm_36plc	18838		.0930			6271	64.0	64.0	176.0	176.0	
normal	16445		.0040			3933	64.0	64.0	176.0	176.0	
	Fwd	Pkts/s						04	_	\	
Inhal	max	count	1	mean		st	d min	25%	50	0%	
Label mitm	264.0	6754.0	3.03	5348	3.	08474:	2 0.0	0.0	3.7708	51	
mitm_36plc			31.11			63646			0.0464		
normal			33.15			68983		0.0	0.0416		
	 0/			d Pkt						\	
Label	75%	m	ax	COI	unt		me	an	:	std	
mitm	6.213025	15.6142	65	675	4.0	3541	5.4980	03 39	919.342	230	
mitm_36plc	62.969913	87.6245		18838			2.8795		123.910		
normal	67.281168	96.6775		16445					279.1419		
		0.5	0/		- O°/			7 - 0/			\
Label	min	25	/•	;	50%			75%		max	
mitm	0.080736	6.36803	6 !	9.511	096	571	42.857	143 1	42857.14	12857	
mitm_36plc		64.64876		5.632			81818.181818 400000.00000				
normal	0.068079	68.80986	5 10	0.4469	989	1428	57.142	857 2	85714.28	35714	
	D1 . T							- -			
	Pkt Len Min		+ 1	in O	5 %	E0% '	75% m		Len Max		
Label	count	mean s	td m	111 2	۰/۵	JU/ ₀	ıυ⁄₀ M	ax	coun	L .	
mitm	6754.0	0.0 0	.0 0	.0 0	.0	0.0	0.0 0	.0	6754.0)	
mitm_36plc	188383.0								188383.0		

normal	164457.0	0.0	0.0	0.0	0.0	0.0 0.0	164457.0)				
Label	mean	;	std mir	n 25%	50%	75% ma	Pkt Len	Mean \				
mitm mitm_36plc normal	35.010364 34.898733 34.897913	35.021 34.916 34.918	179 0.0	0.0	68.0 66.0 66.0	70.0 72. 68.0 72. 68.0 72.	0 1883	754.0 883.0 157.0				
Label	mean	sto	d min	25%	5	0%	75%	max				
mitm mitm_36plc normal	7.821808 7.858376 7.857901	7.82143 7.85661 7.85673	1 0.0	0.0 13	. 1538 . 3846 . 3846	15 15.636	364 17.20	00000				
Pkt Len Std \												
Label mitm	count		nean	std			50%	75%				
mitm_36plc	6754.0 188383.0			2.152875 2.195228				.371369 .371369				
normal	164457.0	12.19	7651 12	2.195516	0.0	0.0 23.	027297 24	.371369				
Pkt Len Var												
Label	max	C	ount	mea	n	std	min 25%					
mitm	27.804512	67	54.0 29	95.40375	0 29	5.439760	0.0 0.0					
mitm_36plc	25.231374	1883		97.52202		7.476984	0.0 0.0					
normal	24.491928	1644	57.0 28	97.51239	4 29	7.490619	0.0 0.0					
Label	50%	/ .	75%	m	FI ax	N Flag Cnt count		1				
mitm	524.717949			73.0909		6754.0						
mitm_36plc normal	530.256410 530.256410			36.6222 599.8545		188383.0 164457.0						
	000120022						0.000200					
Label	std	min 25	6 50%	75% ma		Flag Cnt count	mean	\				
mitm	0.500037	0.0 0.				6754.0	0.499852					
mitm_36plc normal	0.500001 0.500002	0.0 0.0		1.0 1. 1.0 1.		188383.0 164457.0	0.499859 0.499894					
					RST	Flag Cnt						
Label	std	min 25	% 50%	75% ma	X	count	mean std	min				

```
0.500037
                      0.0 0.0 0.0 1.0
                                          1.0
                                                     6754.0 0.0
                                                                  0.0
                                                                       0.0
                                          1.0
            0.500001
                      0.0
                          0.0
                                0.0 1.0
                                                   188383.0
                                                             0.0
                                                                  0.0
                                                                       0.0
mitm 36plc
normal
            0.500002
                     0.0 0.0
                                0.0
                                     1.0
                                          1.0
                                                   164457.0
                                                             0.0
                                                                  0.0
                                                                       0.0
                               PSH Flag Cnt
            25%
                50%
                      75%
                                      count mean
                                                             25%
                                                                  50%
                                                                       75%
                           max
                                                   std
                                                       min
Label
mitm
            0.0 0.0
                     0.0
                           0.0
                                      6754.0
                                              0.0
                                                   0.0
                                                        0.0
                                                             0.0
                                                                  0.0
                                                                       0.0
            0.0 0.0
mitm 36plc
                      0.0
                                              0.0
                                                   0.0
                                                        0.0
                                                             0.0
                                                                  0.0
                           0.0
                                   188383.0
                                                                       0.0
normal
            0.0 0.0
                      0.0
                           0.0
                                   164457.0
                                              0.0
                                                   0.0
                                                        0.0
                                                             0.0
                                                                  0.0
                                                                       0.0
                ACK Flag Cnt
            max
                       count
                                              std
                                                  min
                                                        25%
                                                             50%
                                                                  75%
                                  mean
                                                                       max
Label
            0.0
                              0.500148
                                        0.500037
mitm
                      6754.0
                                                   0.0
                                                        0.0
                                                             1.0
                                                                  1.0
                                                                       1.0
                                        0.500001
mitm_36plc
            0.0
                    188383.0 0.500141
                                                   0.0
                                                        0.0
                                                             1.0
                                                                  1.0
            0.0
                                                   0.0
                                                             1.0
normal
                    164457.0 0.500106
                                        0.500002
                                                        0.0
                                                                  1.0
           URG Flag Cnt
                                                            CWE Flag Count
                                        25%
                                              50%
                                                   75%
                                                                     count
                  count mean
                              std
                                   min
                                                        max
Label
mitm
                              0.0
                                   0.0
                                        0.0
                                              0.0
                                                   0.0
                                                        0.0
                 6754.0
                         0.0
                                                                    6754.0
mitm_36plc
               188383.0
                         0.0
                              0.0
                                   0.0
                                        0.0
                                              0.0
                                                   0.0
                                                        0.0
                                                                  188383.0
                         0.0 0.0
                                   0.0
                                        0.0
                                              0.0
                                                   0.0
                                                        0.0
normal
               164457.0
                                                                  164457.0
                                               ECE Flag Cnt
           mean
                 std
                     min
                          25%
                                50%
                                     75%
                                          max
                                                      count mean
                                                                  std
                                                                       min
Label
mitm
            0.0 0.0
                      0.0
                           0.0
                                0.0
                                     0.0
                                          0.0
                                                     6754.0
                                                             0.0
                                                                  0.0
                                                                       0.0
            0.0 0.0
                      0.0
                           0.0
                                0.0
                                     0.0
                                          0.0
                                                   188383.0
                                                             0.0
                                                                  0.0
mitm_36plc
                                                                       0.0
normal
            0.0 0.0 0.0 0.0
                               0.0 0.0
                                          0.0
                                                                       0.0
                                                   164457.0
                                                             0.0
                                                                  0.0
                               Down/Up Ratio
            25%
                 50%
                      75%
                           max
                                       count
                                                   mean
                                                              std
                                                                   min
                                                                        25%
Label
mitm
            0.0
                 0.0
                      0.0
                           0.0
                                      6754.0 0.500444
                                                         0.500629
                                                                   0.0
                                                                        0.0
            0.0 0.0
                      0.0
                           0.0
                                     188383.0
                                              0.500422
                                                         0.500574
                                                                   0.0
                                                                       0.0
mitm_36plc
normal
            0.0 0.0
                     0.0 0.0
                                     164457.0 0.500283
                                                        0.500427
                                                                   0.0
                          Pkt Size Avg
                                                                              \
            50%
                 75%
                                 count
                                                        std
                                                             min
                                                                  25%
                                                                         50%
                      max
                                             mean
Label
mitm
            1.0 1.0
                      2.0
                                 6754.0 8.603843
                                                   8.603407
                                                             0.0
                                                                  0.0
                                                                       14.25
                                                   8.642232
mitm_36plc
            1.0 1.0
                      2.0
                              188383.0 8.644150
                                                             0.0
                                                                  0.0
                                                                       14.50
                      2.0
normal
            1.0 1.0
                              164457.0 8.643638
                                                   8.642374
                                                             0.0
                                                                  0.0
                                                                       14.50
```

Fwd Seg Size Avg

	75%		ma	x		С	ount		mean		ŝ	std	min	25%	
Label mitm	17.2	21 9	81818	n		67	54.0	0.7	49585	۵	755	730	0.0	0.0	
mitm_36plc			11111			1883			49303 46797		750:		0.0	0.0	
normal	17.2		40000			1644			49339		7532		0.0	0.0	
				Bw	ıd Seg	g Siz	e Avg								\
	50%	759	% m	ax			count		mea	n		std	min	25%	
Label															
mitm	18.0	19.					754.0		48094			6550			
mitm_36plc	18.0	19.5					383.0		56397			7124			
normal	18.0	19.5	2 20	.0		164	457.0	7.	55870	2 7	.572	2162	0.0	0.0	
Fwd Byts/b Avg															
	50	0% .	75%		max		•		t mea	n s	td	min	25%	50%	
Label															
mitm	12.3			16.66	66667			754.			.0	0.0			
mitm_36plc	12.00				66667			383.			.0	0.0			
normal	12.00	00 1	5.6	16.66	66667		164	457.	0 0.	0 0	.0	0.0	0.0	0.0	
Fwd Pkts/b Avg															
	75%	max			count	mean	std	mi	n 25	% 5	0%	75%	max		
Label															
mitm	0.0	0.0		67	754.0	0.0	0.0	0.	0 0.	0 0	.0	0.0	0.0		
mitm_36plc	0.0	0.0		1883	383.0	0.0	0.0	0.	0 0.	0 0	.0	0.0	0.0		
normal	0.0	0.0		1644	157.0	0.0	0.0	0.	0 0.	0 0	.0	0.0	0.0		
	Fwd B	lle Ra	to 1	ď								B _{7.7}	d B ₁₇ +	s/b A	wa \
	rwa b	LK IIA		ප t mea	an si	td m	in 2	5%	50%	75%	max		а Бус	cou	_
Label			coun	o moc		Ju III	111 2	O 76	0070	1070	maz			004	110
mitm		(6754.	0 0.	0 0	.0 0	.0 0	.0	0.0	0.0	0.0	Э		6754	.0
mitm_36plc		188	8383.	0 0.	0 0	.0 0	.0 0	.0	0.0	0.0	0.0	С	1	88383	.0
normal		164	4457.	0 0.	0 0	.0 0	.0 0	.0	0.0	0.0	0.0	С	1	64457	.0
								Bud	Pkts	/h ^	37.CC				\
	mean	std	min	25%	50%	75%	max		. I K US		_	nean	st.d	min	`
Label	moun	Doa		2070	0070	. 070	man			004			Doa		
mitm	0.0	0.0	0.0	0.0	0.0	0.0	0.0			6754	.0	0.0	0.0	0.0	
mitm_36plc	0.0		0.0		0.0	0.0				8383		0.0			
normal	0.0	0.0	0.0	0.0	0.0	0.0	0.0		16	4457	.0	0.0	0.0	0.0	
					Bwd I	31k R	ate A	vg							\
	25%	50%	75%	max			cou	nt m	ean	std	miı	n 2	5% 5	0% 7	5%
Label	_	_	_						_	_		_			
mitm	0.0	0.0	0.0	0.0			6754			0.0	0.0				.0
mitm_36plc	0.0	0.0	0.0	0.0			88383			0.0	0.0				.0
normal	0.0	0.0	0.0	0.0		1	64457	.0	0.0	0.0	0.0	0 0	.0 0	.0 0	.0

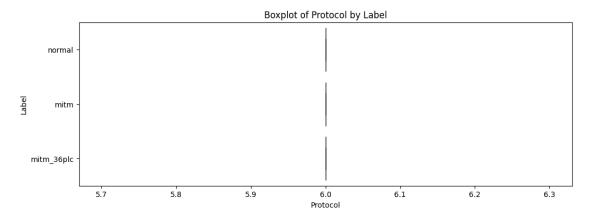
	Su	bflow Fwd	Pkts										١
	max	C	ount	me	an	st	td m	in 2	5% 5	0% 7	′5%	max	
Label													
mitm	0.0	67	54.0	2.4490	67 2	2.45742	26 0	.0 0	.0 4	.0 5	.0	6.0	
mitm_36plc	0.0	1883	83.0	2.4566	39 2	2.46410	04 0	.0 0	.0 4	.0 5	5.0	6.0	
normal	0.0	1644	57.0	2.4598	04 2	2.46689	97 0	.0 0	.0 4	.0 5	.0	6.0	
	Subflow	Fwd Byts										\	
		count		mean		std	min	25%	50%	75	5%		
Label													
mitm		6754.0	47.78			99579	0.0	0.0	72.0				
mitm_36plc		188383.0	47.90			29617	0.0	0.0	72.0				
normal		164457.0	47.98	31515	48.19	93465	0.0	0.0	72.0	96.	0		
		Subflow Bw						2	O.E.0/	E0%	750	\	
Label	max		count	; 1	mean		std	min	25%	50%	75%	/ ₀	
mitm	168.0		675/ () 2 EE	215/	1.569	າຄາດ	1 0	2 0	E 0	E (1	
	100.0		6754.0 8383.0					1.0	2.0	5.0	5.0 5.0		
mitm_36plc	100.0		0303.0 4457.0			1.558 1.553		2.0	2.0	5.0			
normal	100.0	10	4457.0	3.04	1313	1.550	3019	2.0	2.0	5.0	5.0	J	
	Sui	bflow Bwd 1	Rvts										\
	max		ount	m	ean		std	min	25%	50%		75%	`
Label									_070	007		. 070	
mitm	8.0	67	54.0	38.269	174	38.660	0947	0.0	0.0	72.0	7:	2.0	
mitm_36plc	8.0	1883		38.543		38.853		0.0	0.0	72.0		3.0	
normal	8.0	1644		38.461		38.756		0.0	0.0	72.0		3.0	
		Init Fwd W	in Byt	s							\		
	max		cour	ıt mean	sto	d min	25%	50%	75%	max	:		
Label													
mitm	100.0		6754.	0 -1.0	0.0	0 -1.0	-1.0	-1.0	-1.0	-1.0)		
mitm_36plc	100.0			0 -1.0		0 -1.0							
normal	100.0	1	64457.	0 -1.0	0.0	0 -1.0	-1.0	-1.0	-1.0	-1.0)		
	Init Bw	d Win Byts						0.5	۰, -	O9/	7-0/	\	
T - 1 7		count		mean		std	min	25	% 5	0%	75%		
Label		0754 0	00.0		0 0	24455	00 0	00	0 00				
mitm		6754.0		396062			83.0				5.0		
mitm_36plc		188383.0		12099		96132	83.0				35.0		
normal		164457.0	83.5	18084	0.99	90091	83.0	83.	0 83	.0 8	85.0		
	E,	wd Act Dat	a Dlr+c									\	
	max	wa neo Dab	count		mean		std	min	25%	50%	759	γ <u>΄</u>	
Label	max		Jount				Dua	11	20%	00%	, 0,	v	
mitm	85.0		6754.0	1.00	0740	1.000	0740	0.0	0.0	2.0	2.0)	
									•			-	

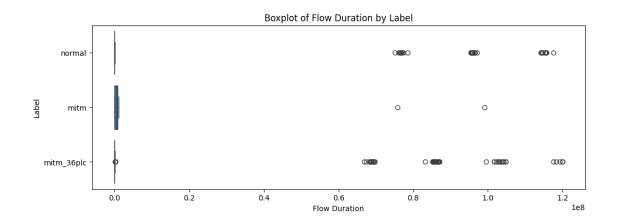
```
188383.0 1.000292 1.000003 0.0 0.0 2.0 2.0
mitm_36plc
            85.0
            85.0
                          164457.0 1.000213 1.000003 0.0 0.0 2.0 2.0
normal
                Fwd Seg Size Min
                                                25%
                                                      50%
            max
                           count mean std min
                                                          75% max
Label
            3.0
                          6754.0 0.0 0.0 0.0
                                                 0.0
                                                      0.0
                                                           0.0
mitm
mitm_36plc
            2.0
                        188383.0
                                  0.0
                                       0.0
                                            0.0
                                                 0.0
                                                      0.0
                                                           0.0
            2.0
                        164457.0 0.0 0.0 0.0
                                                0.0 0.0
                                                           0.0
normal
           Active Mean
                                                                      \
                 count
                                                 25%
                                                      50%
                                                           75%
                            mean
                                       std
                                           min
                                                                 max
Label
mitm
                6754.0
                        0.008884
                                  0.549823
                                            0.0
                                                 0.0
                                                      0.0
                                                           0.0
                                  0.236835
                                            0.0
                                                 0.0
                                                      0.0
mitm 36plc
              188383.0
                        0.003668
                                                           0.0
                                                                27.0
                                                0.0 0.0
normal
              164457.0
                       0.003867
                                  0.287735
                                            0.0
                                                          0.0
                                                               36.0
           Active Std
                                                         Active Max
                count mean
                            std min
                                      25%
                                           50%
                                                75%
                                                              count
                                                     max
                                                                         mean
Label
                            0.0
                                           0.0
                                                0.0
                                                     0.0
mitm
               6754.0
                       0.0
                                 0.0
                                      0.0
                                                             6754.0
                                                                     0.008884
             188383.0
                       0.0
                            0.0
                                 0.0
                                      0.0
                                           0.0
                                                0.0
                                                     0.0
mitm 36plc
                                                           188383.0
                                                                     0.003668
normal
             164457.0 0.0
                           0.0
                                 0.0
                                     0.0
                                           0.0 0.0
                                                     0.0
                                                           164457.0
                                                                     0.003867
                                               Active Min
                 std
                      min
                           25%
                                50%
                                     75%
                                                    count
                                                                          std
                                           max
                                                               mean
Label
            0.549823
                      0.0
                           0.0
                                0.0
                                     0.0 41.0
                                                   6754.0
                                                           0.008884
mitm
                                                                     0.549823
mitm_36plc
            0.236835
                      0.0
                           0.0
                                0.0
                                     0.0 27.0
                                                 188383.0
                                                           0.003668
                                                                     0.236835
                      0.0
                          0.0
                                0.0
                                    0.0
                                         36.0
                                                           0.003867
normal
            0.287735
                                                 164457.0
                                                                     0.287735
                                     Idle Mean
                 25%
            min
                      50%
                           75%
                                         count
                                                                       std
                                 max
                                                        mean
Label
mitm
            0.0 0.0
                      0.0
                           0.0
                                41.0
                                        6754.0
                                                25647.077584 1.503937e+06
mitm_36plc
            0.0 0.0
                      0.0
                           0.0
                                27.0
                                      188383.0
                                                25559.405679
                                                              1.534908e+06
normal
            0.0 0.0
                      0.0
                          0.0
                                36.0
                                      164457.0
                                                20526.033231
                                                             1.423597e+06
                                             Idle Std
                 25%
            min
                      50%
                           75%
                                                count mean
                                                            std
                                                                 min
                                                                      25%
                                        max
Label
            0.0
                 0.0
                      0.0
                           0.0
                                 98355743.0
                                               6754.0
                                                       0.0
                                                            0.0
                                                                 0.0
mitm 36plc
                 0.0
                      0.0
                           0.0
                                119927029.0
                                             188383.0
                                                       0.0
                                                            0.0
                                                                 0.0
            0.0
                                                                      0.0
normal
            0.0
                 0.0
                      0.0
                           0.0
                                117440559.0
                                             164457.0
                                                       0.0
                                                            0.0
                                                                 0.0
                                                                      0.0
                           Idle Max
            50%
                 75%
                      max
                              count
                                             mean
                                                            std
                                                                min
                                                                      25%
```

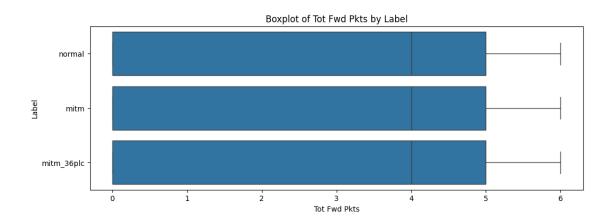
```
Label
mitm
           0.0 0.0 0.0
                            6754.0 25647.077584 1.503937e+06
                                                               0.0
                                                                    0.0
           0.0 0.0
                         188383.0 25559.405679 1.534908e+06
mitm_36plc
                     0.0
                                                               0.0
                                                                    0.0
normal
           0.0 0.0 0.0
                          164457.0 20526.033231 1.423597e+06
                                                               0.0
                                                                    0.0
                                  Idle Min
           50%
               75%
                                     count
                             max
                                                                  std min
                                                   mean
Label
mitm
           0.0 0.0
                      98355743.0
                                    6754.0
                                           25647.077584 1.503937e+06
                                                                      0.0
mitm 36plc
           0.0
                0.0
                     119927029.0
                                  188383.0
                                           25559.405679
                                                        1.534908e+06
                                                                       0.0
normal
           0.0 0.0
                     117440559.0
                                  164457.0 20526.033231
                                                        1.423597e+06
                                                                      0.0
           25% 50%
                    75%
                                  max
Label
           0.0 0.0 0.0
                           98355743.0
mitm
mitm_36plc
           0.0 0.0
                    0.0
                         119927029.0
normal
           0.0 0.0 0.0 117440559.0
```

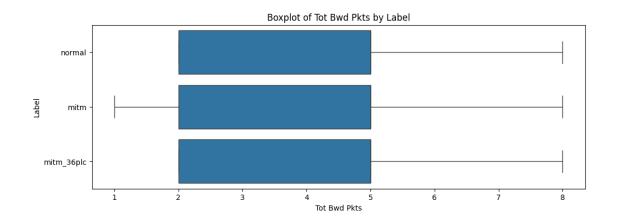
```
[25]: import seaborn as sns
import matplotlib.pyplot as plt

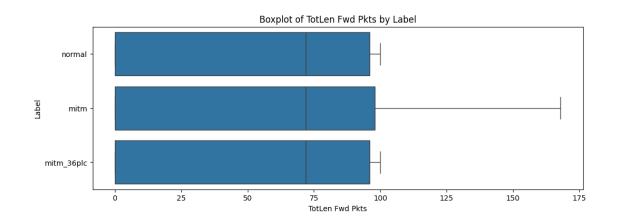
for col in df.select_dtypes(include='number').columns:
    plt.figure(figsize=(12, 4))
    sns.boxplot(y='Label', x=col, data=df)
    plt.title(f'Boxplot of {col} by Label')
    plt.show()
```

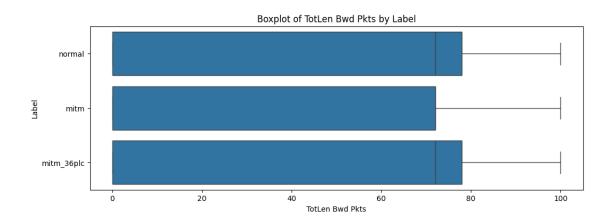


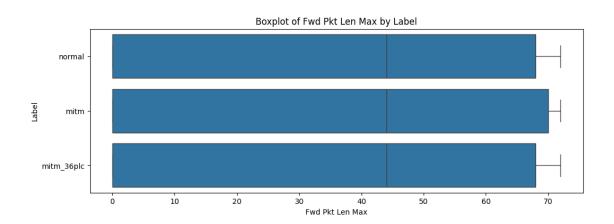


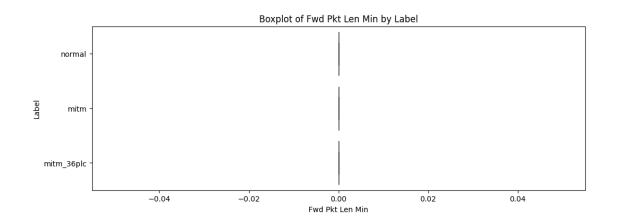


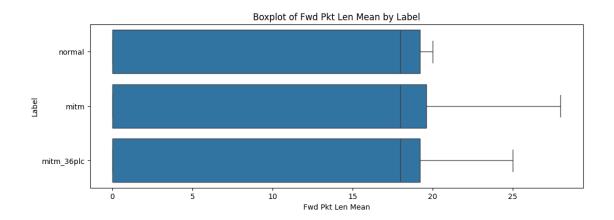


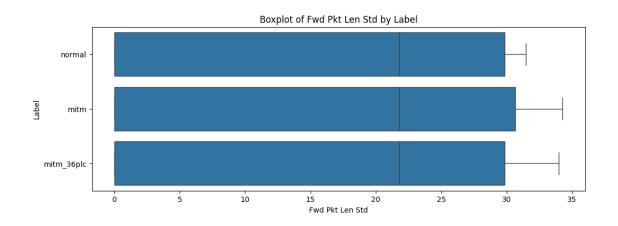


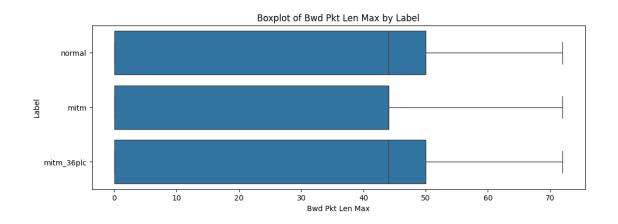


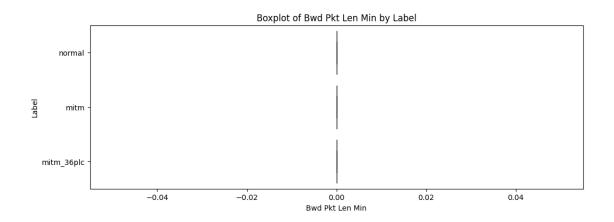


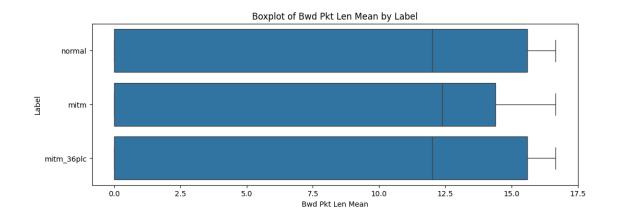


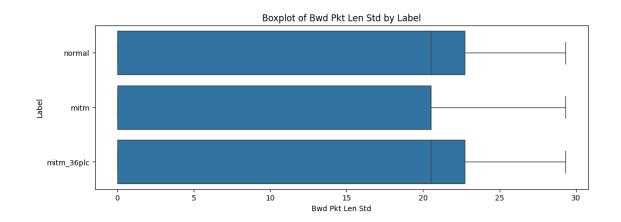


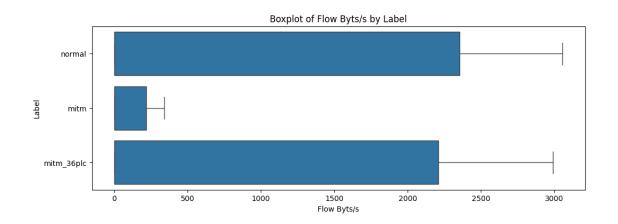


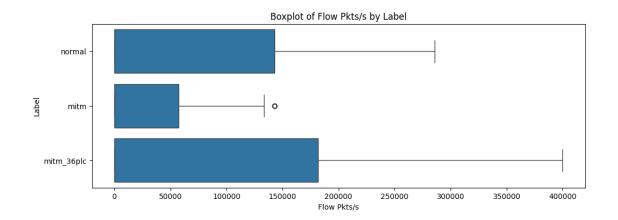


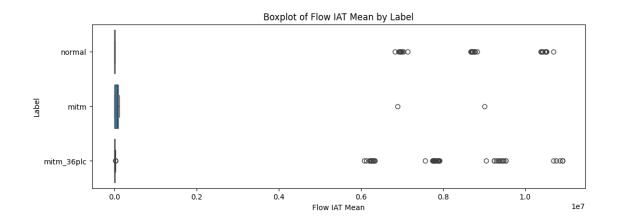


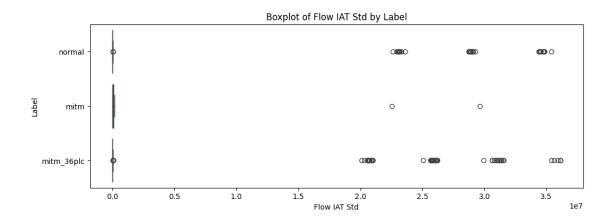


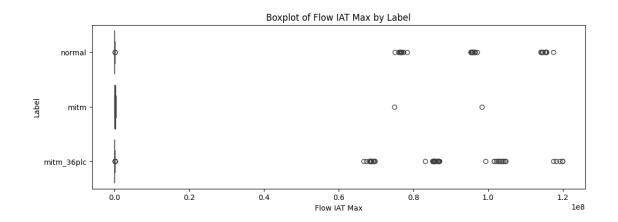


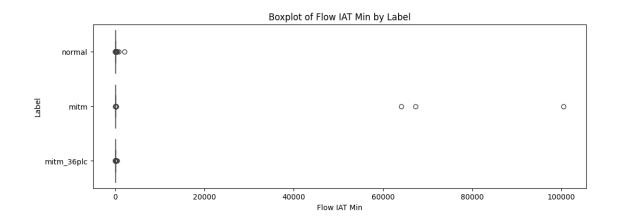


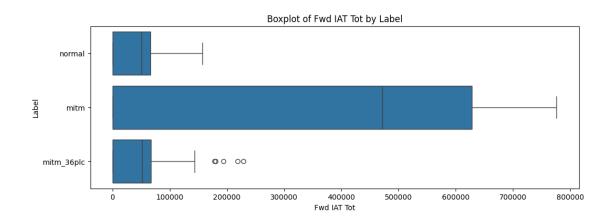


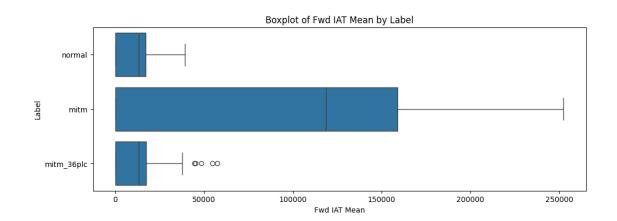


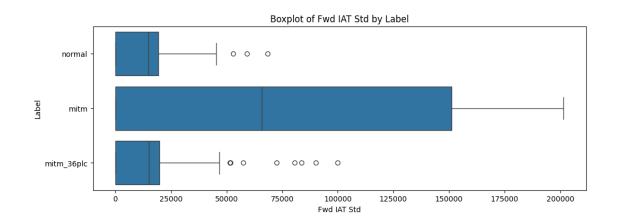


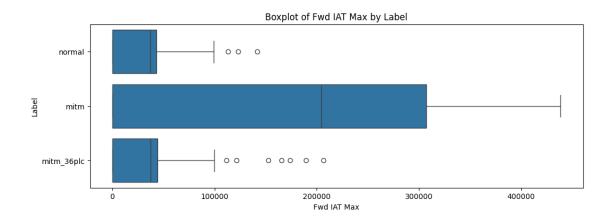


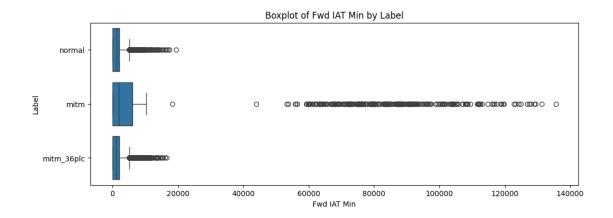


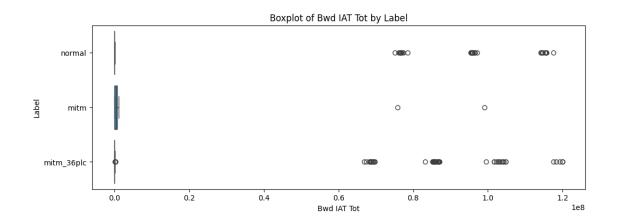


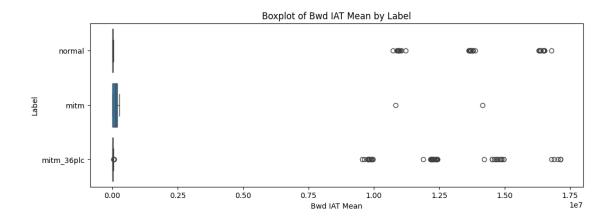


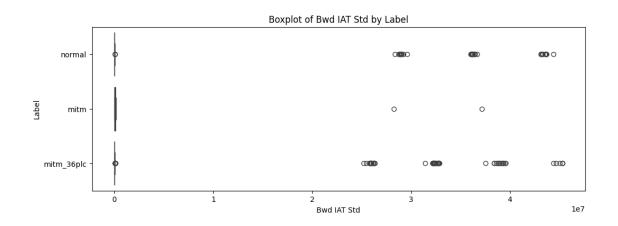


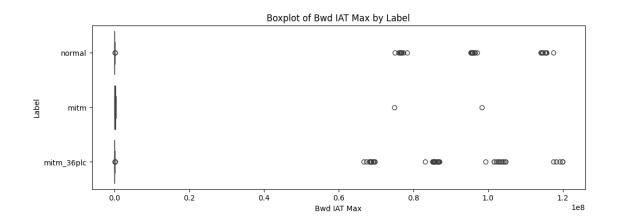


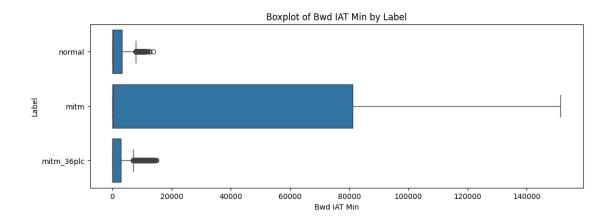


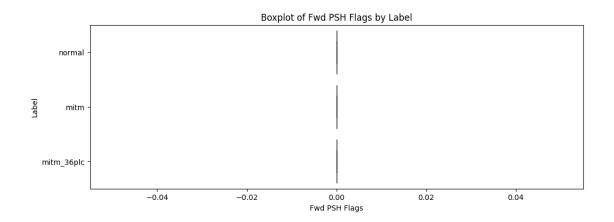


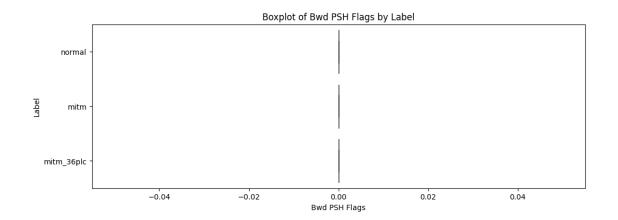


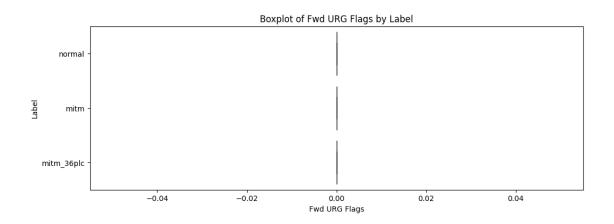


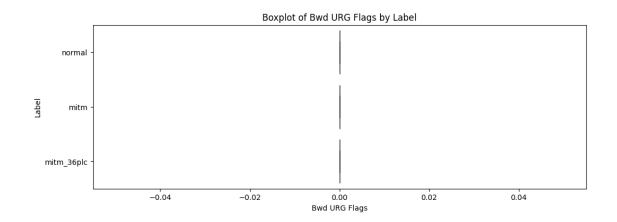


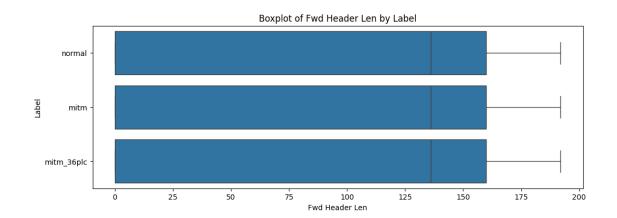


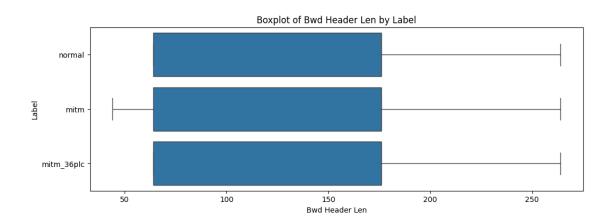


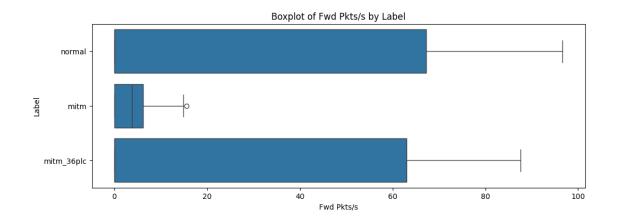


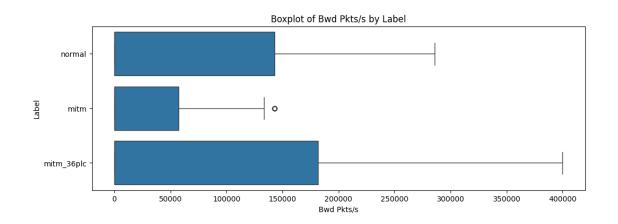


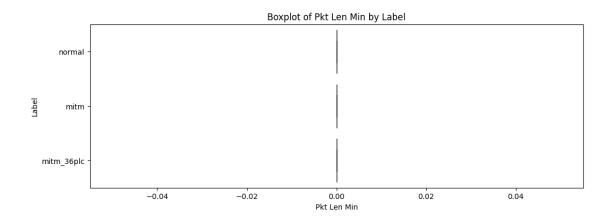


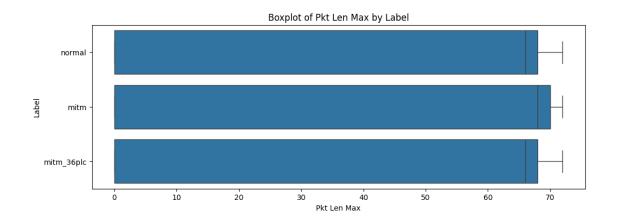


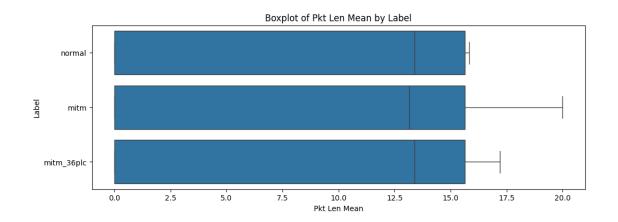


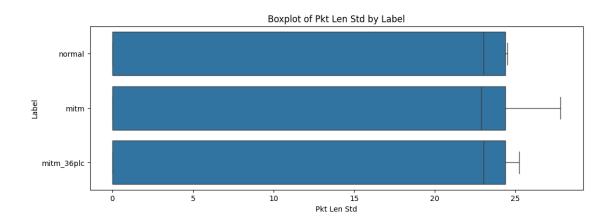


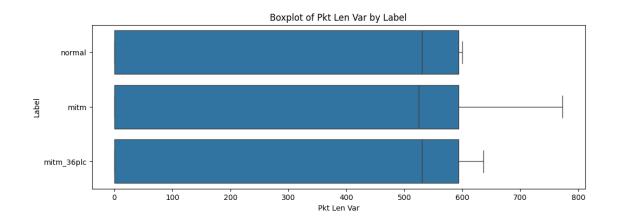


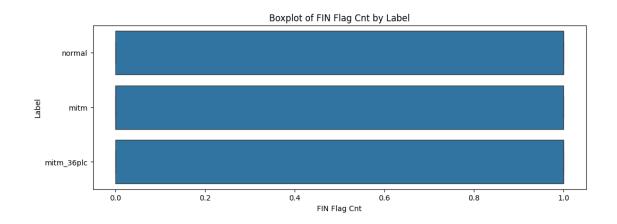


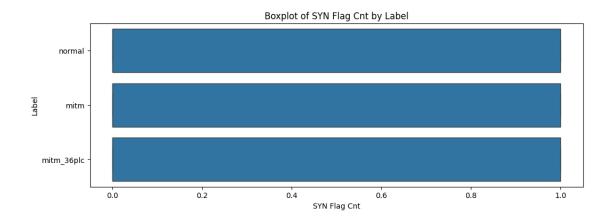


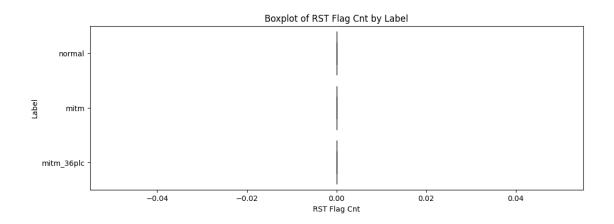


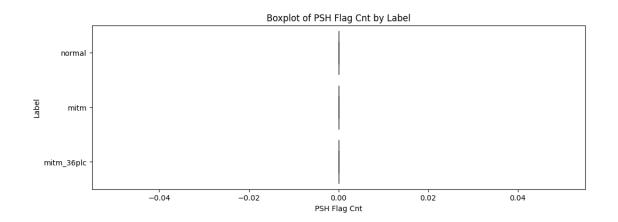


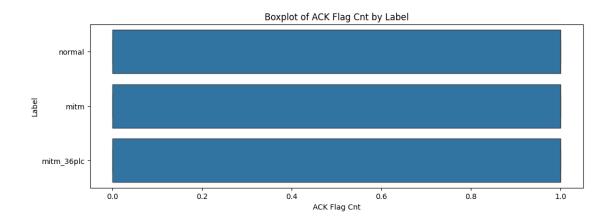


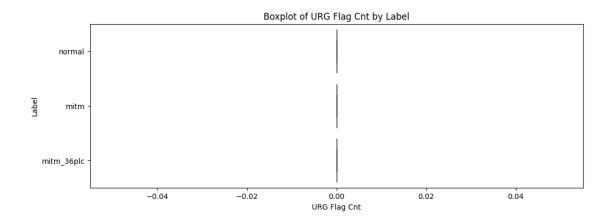


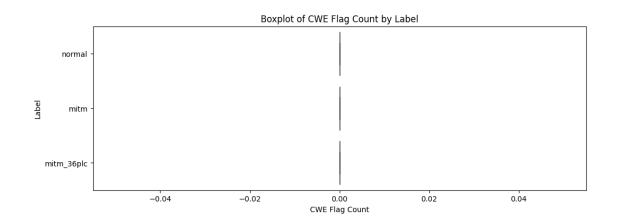


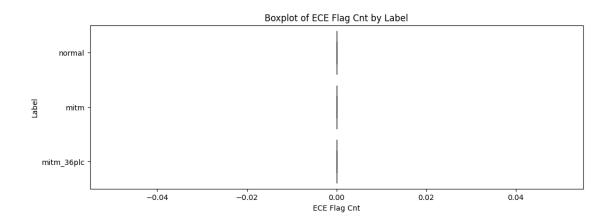


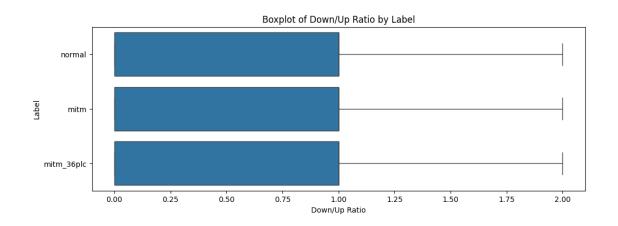


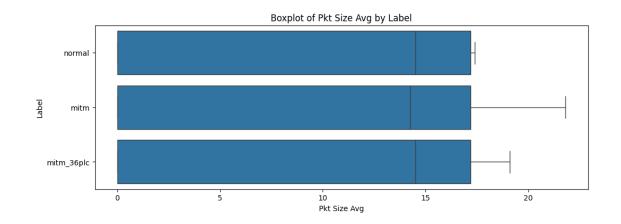


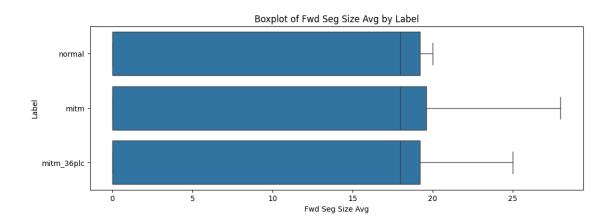


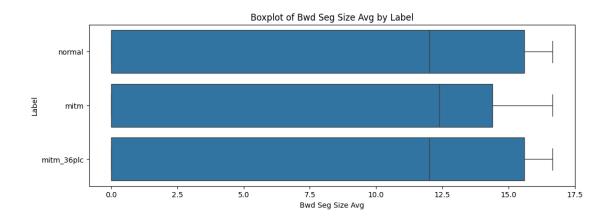


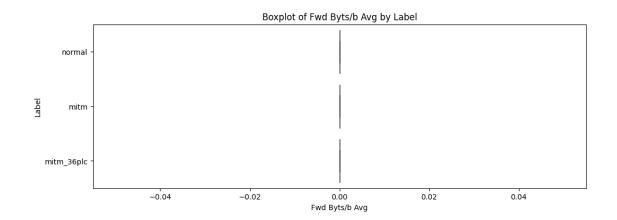


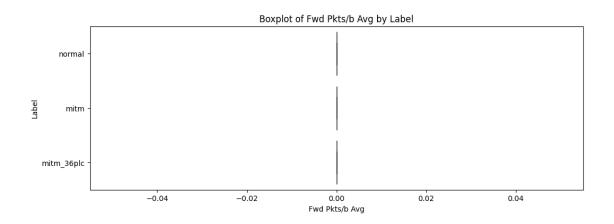


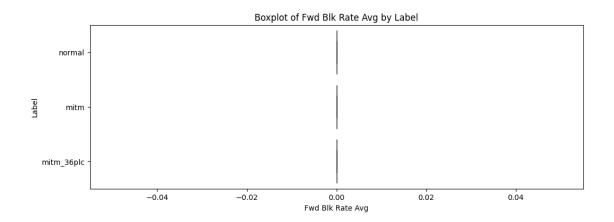


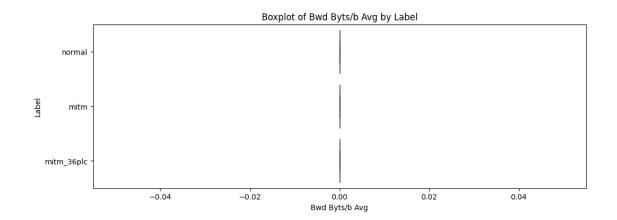


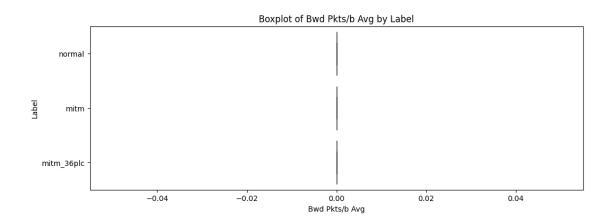


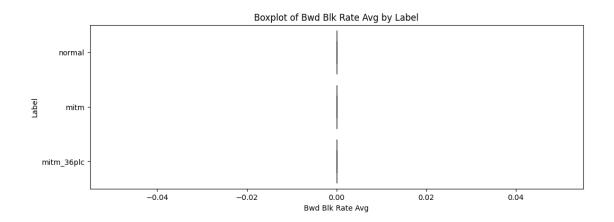


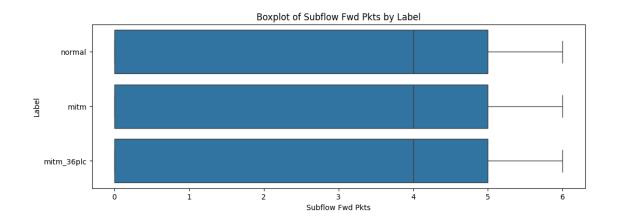


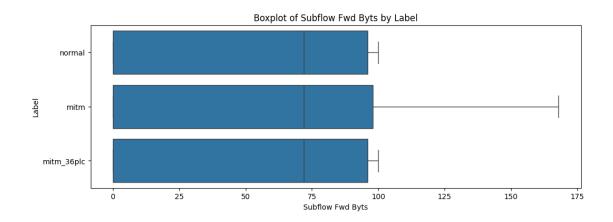


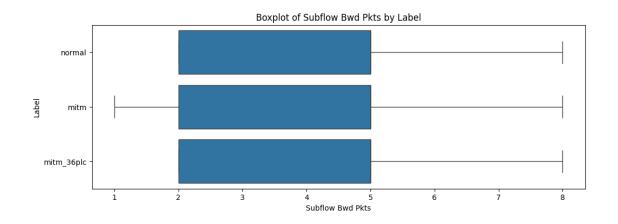


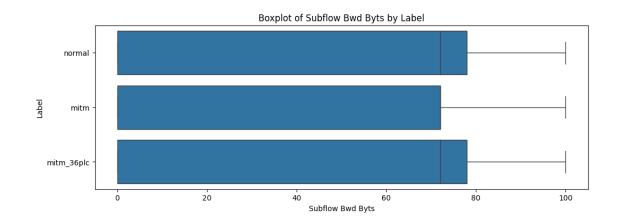


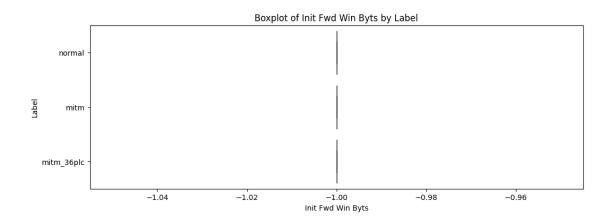


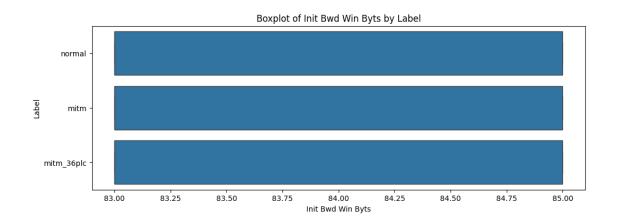


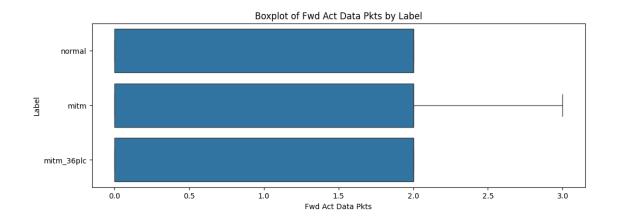


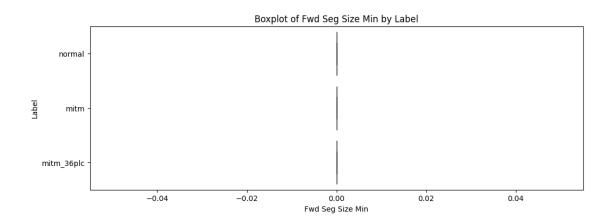


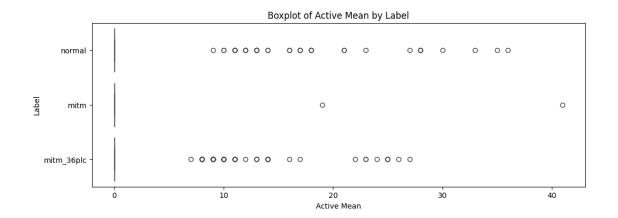


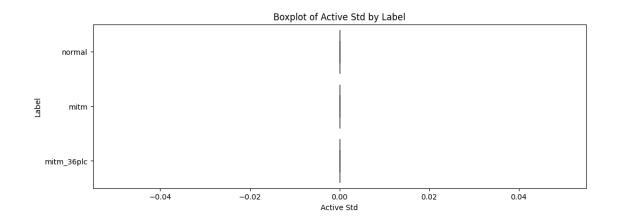




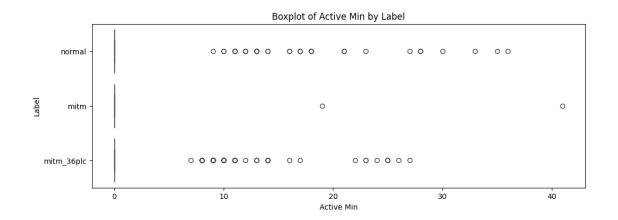


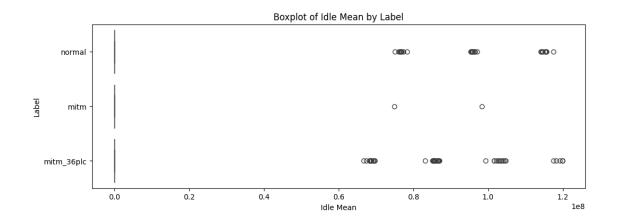


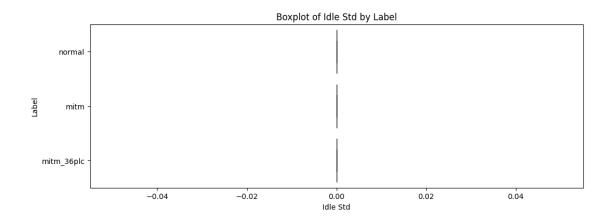


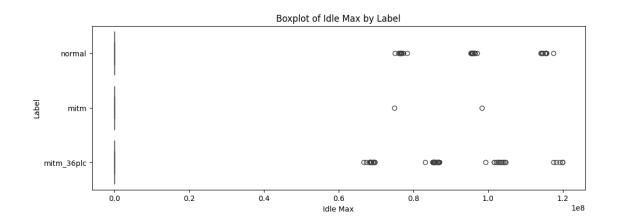


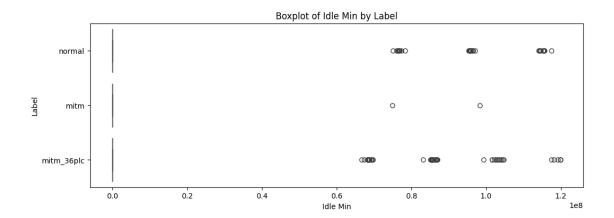




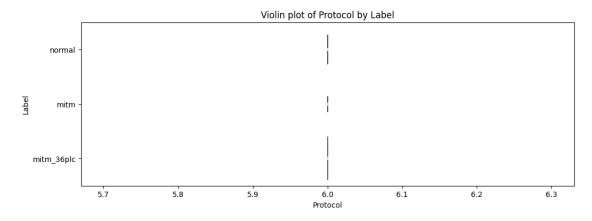


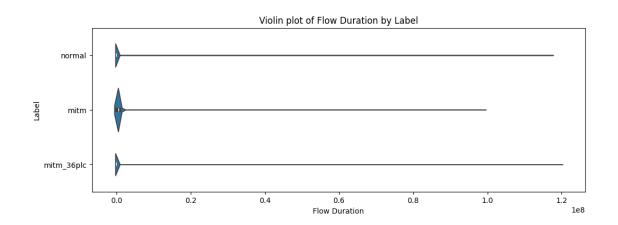


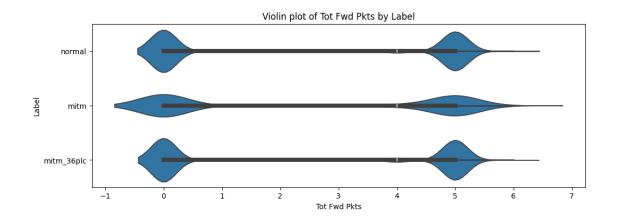


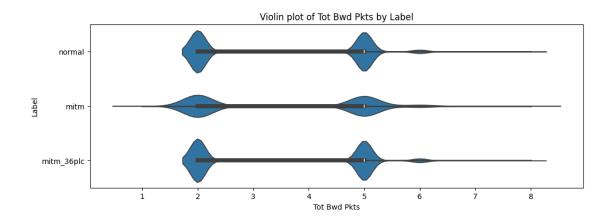


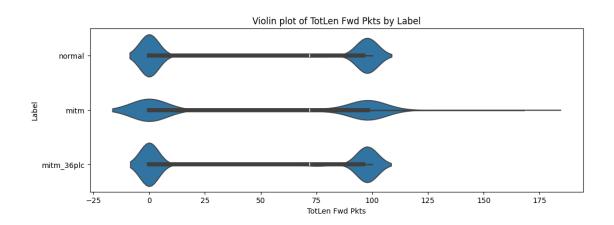
```
[26]: for col in df.select_dtypes(include='number').columns:
    plt.figure(figsize=(12, 4))
    sns.violinplot(y='Label', x=col, data=df)
    plt.title(f'Violin plot of {col} by Label')
    plt.show()
```

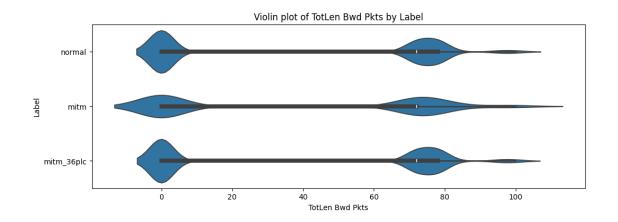


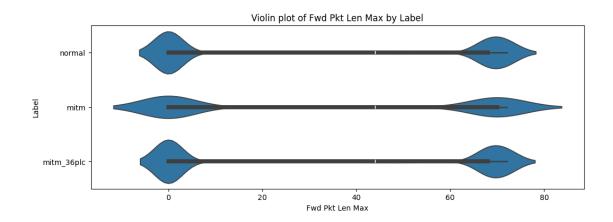


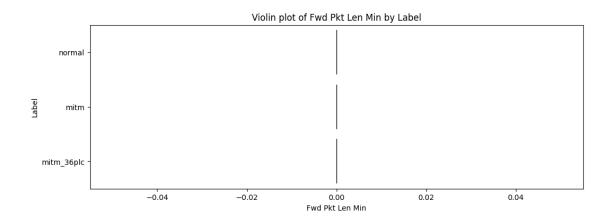


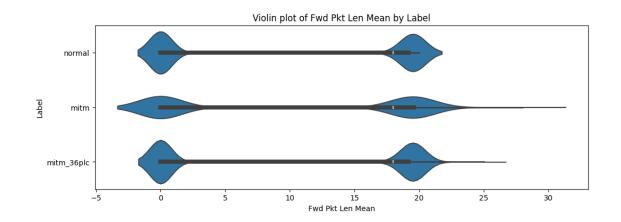


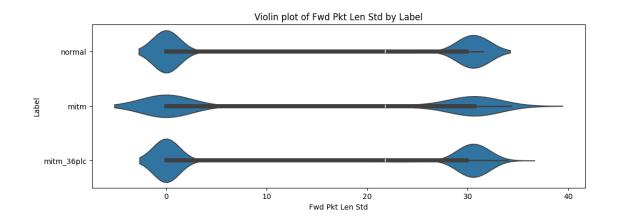


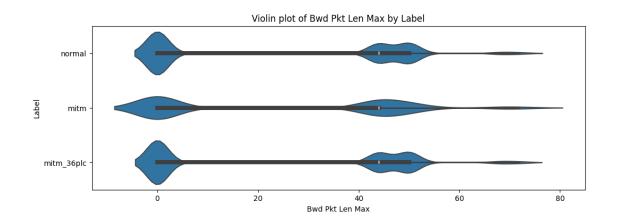


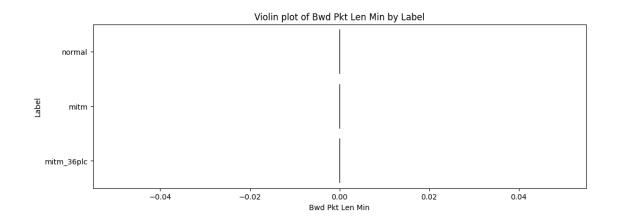


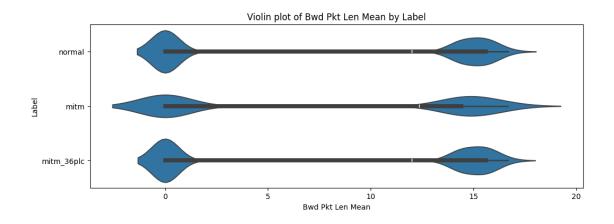


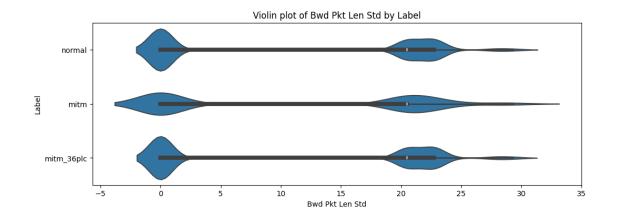


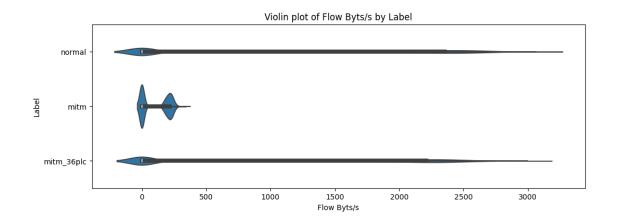


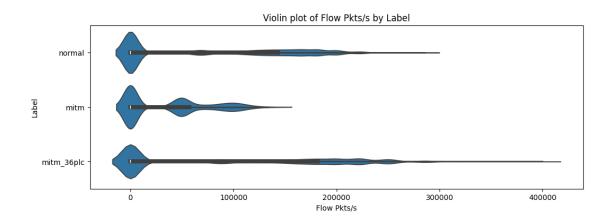


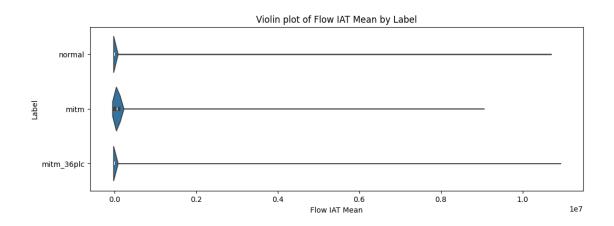


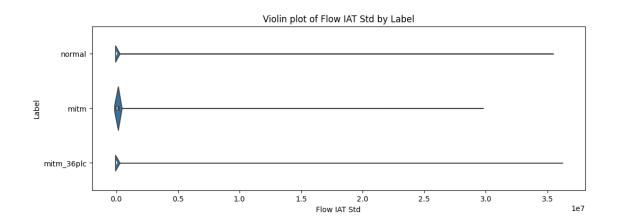


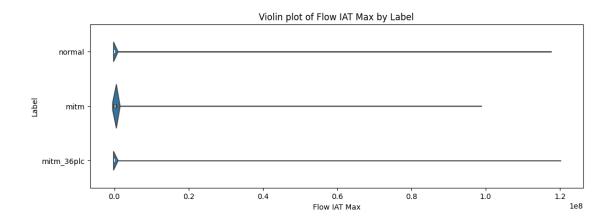


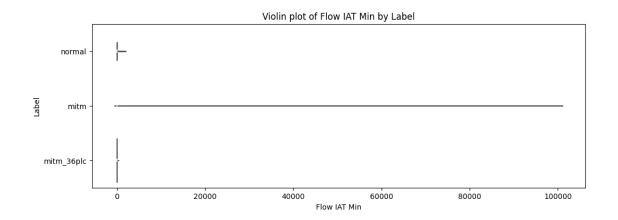


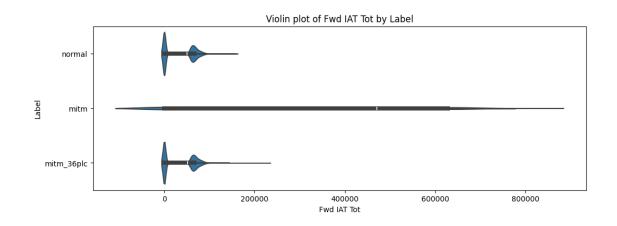


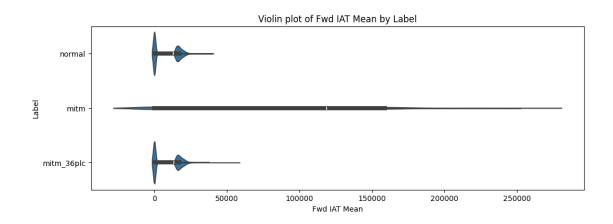


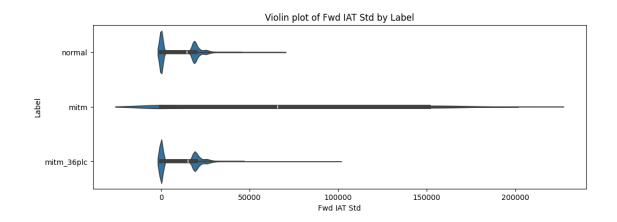


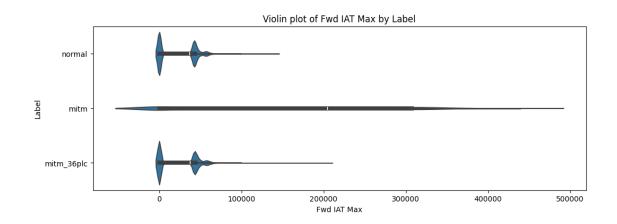


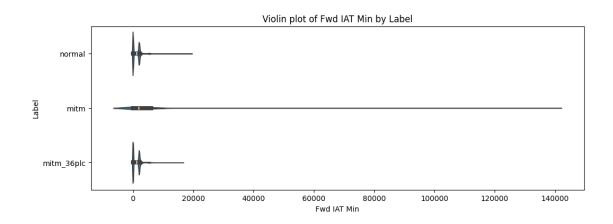


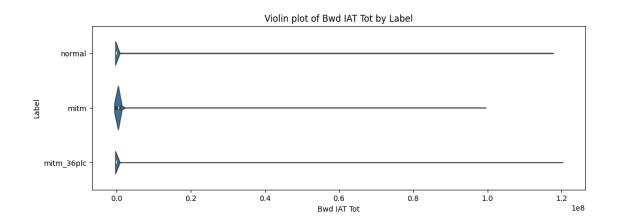


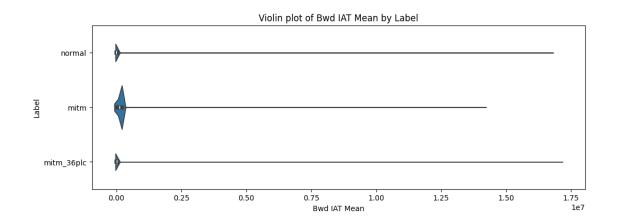


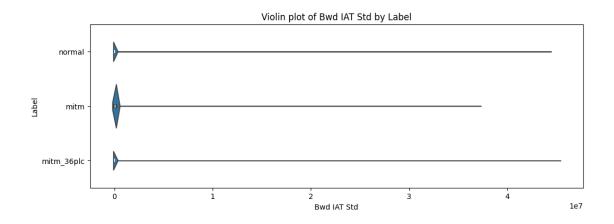


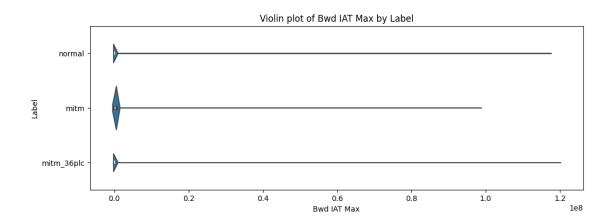


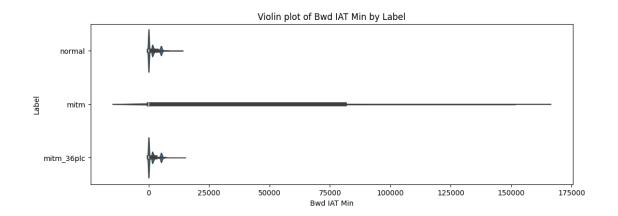


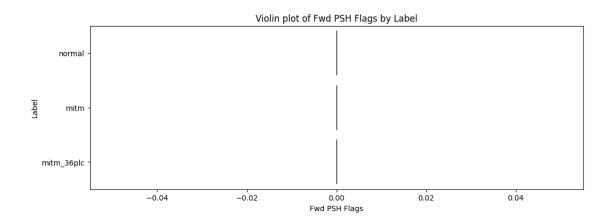


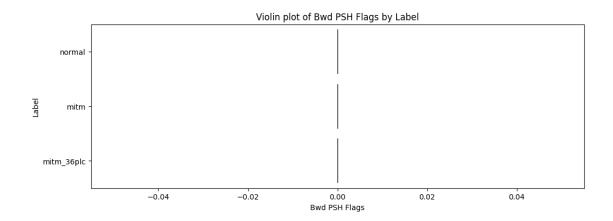


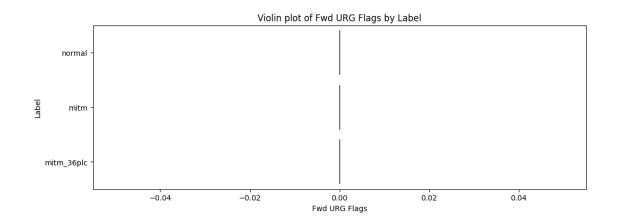


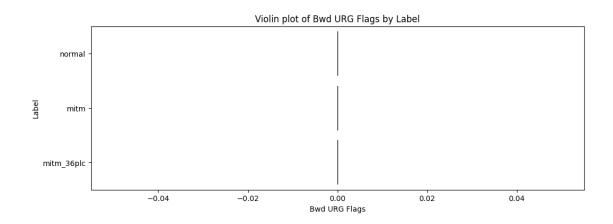


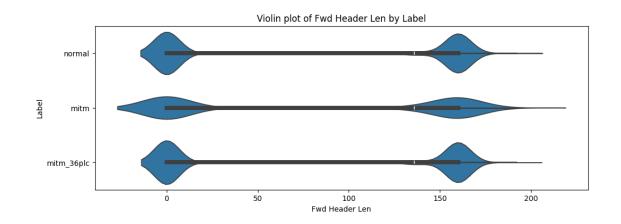


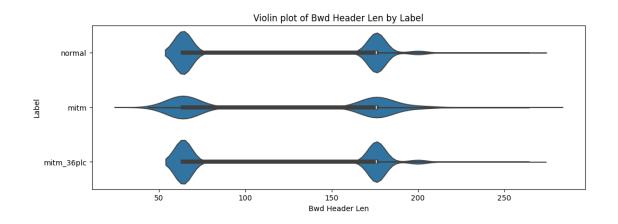


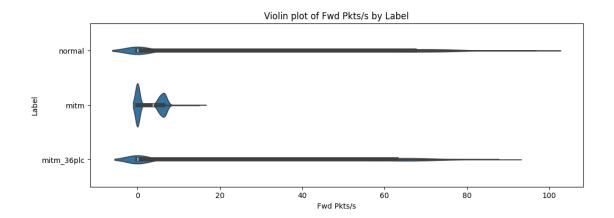


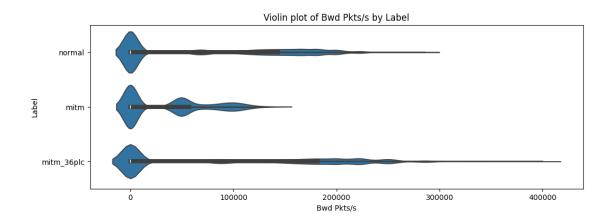


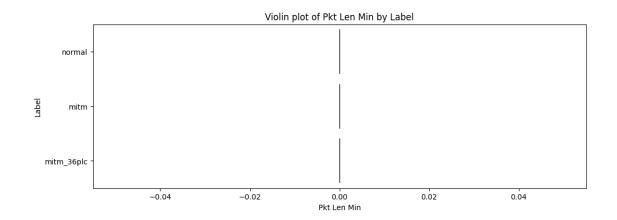


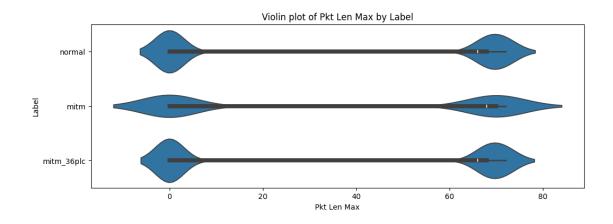


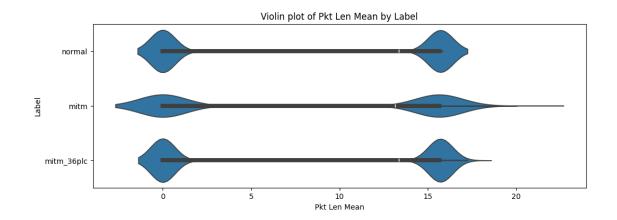


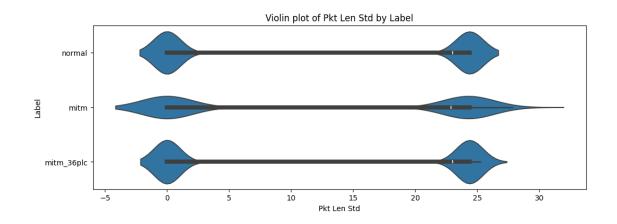


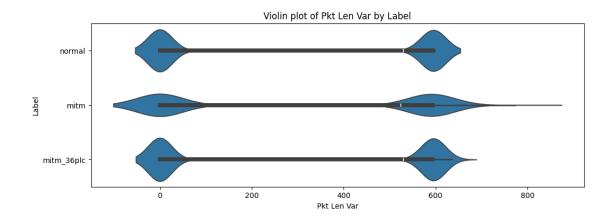


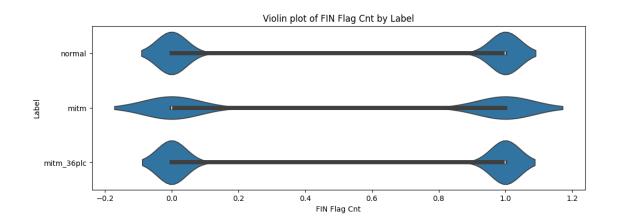


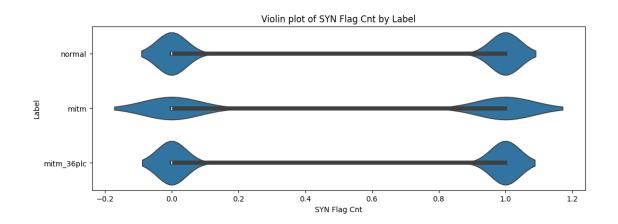


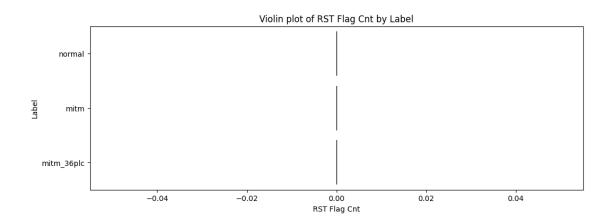


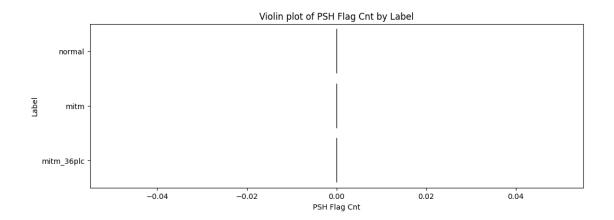


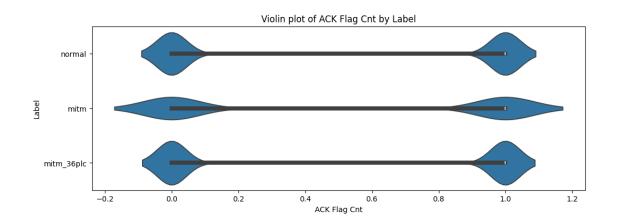


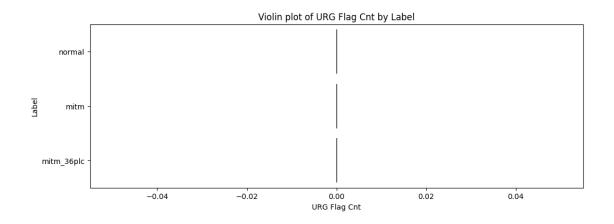


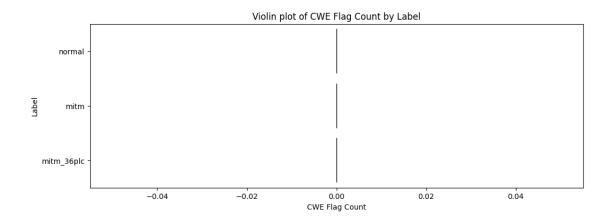


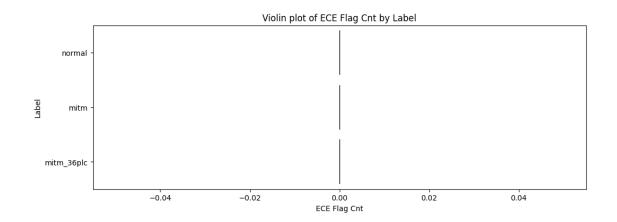


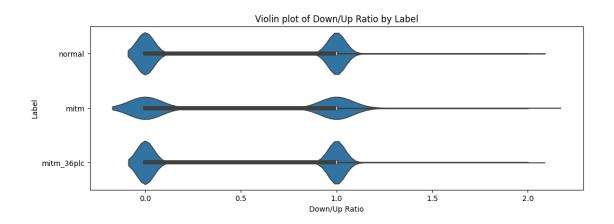


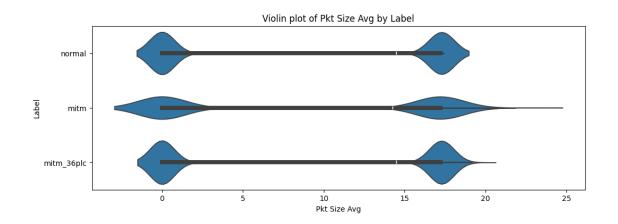


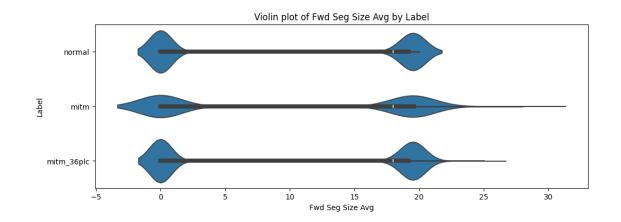


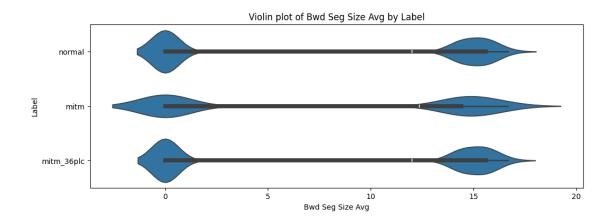


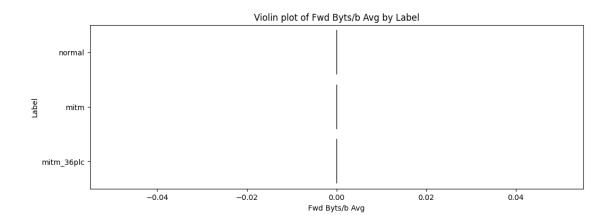


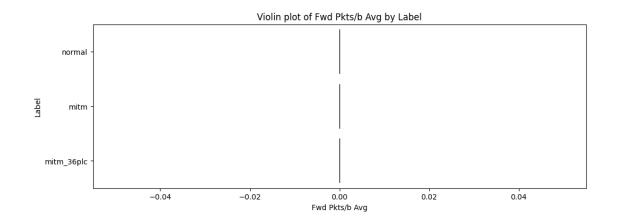


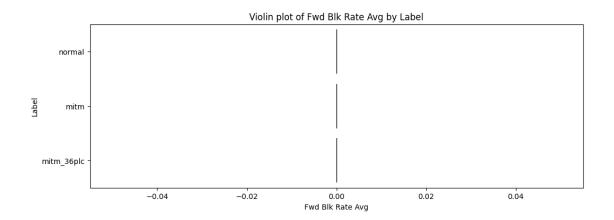


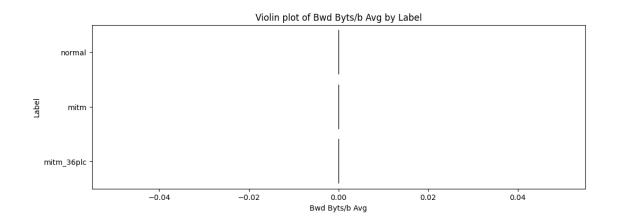


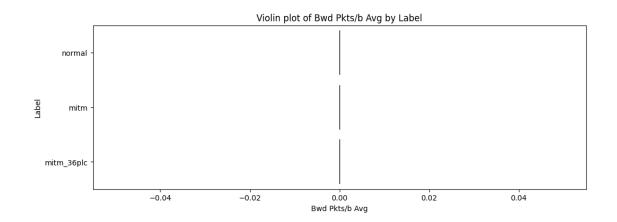


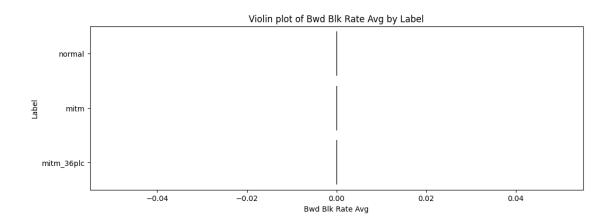


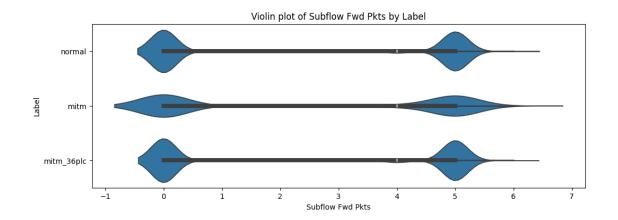


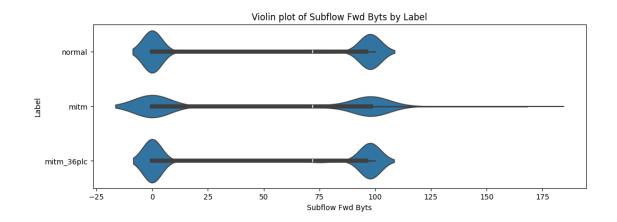


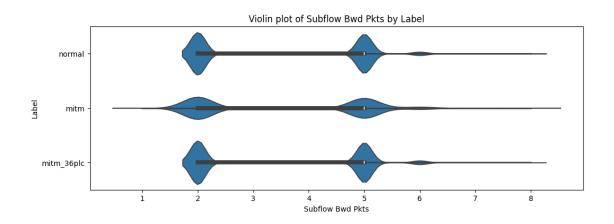


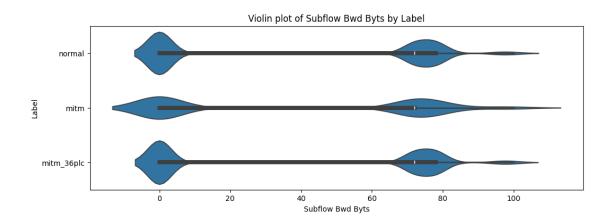


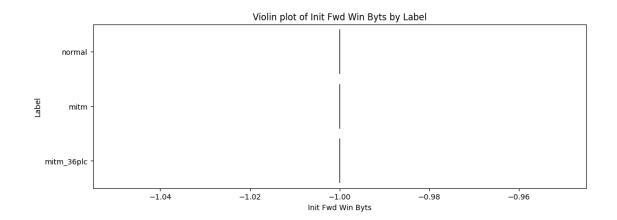


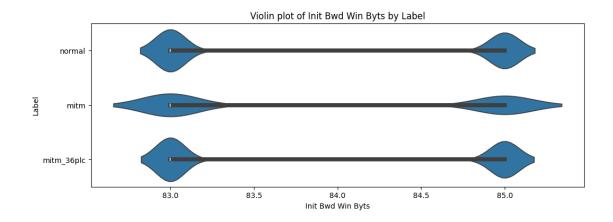


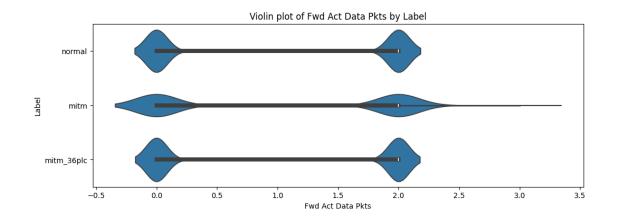


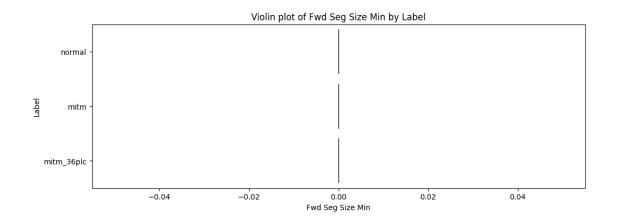


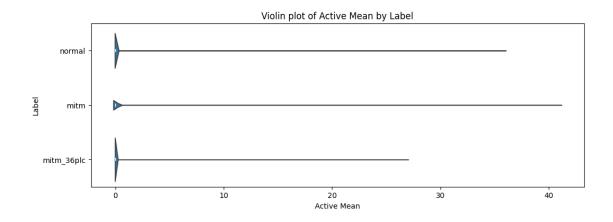


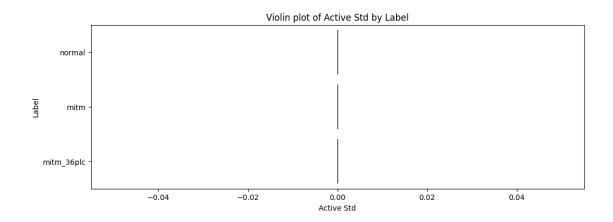


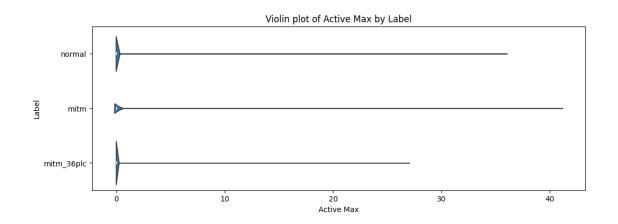


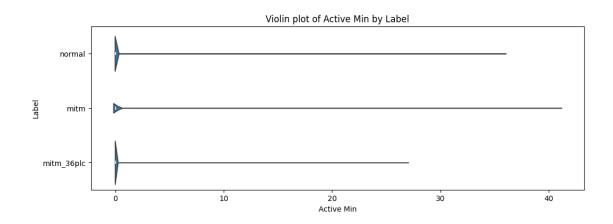


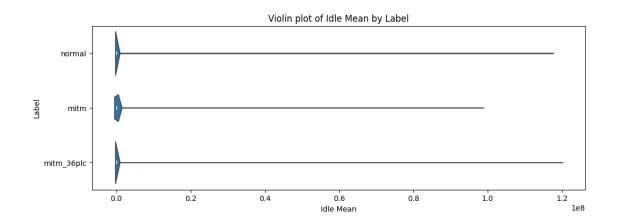


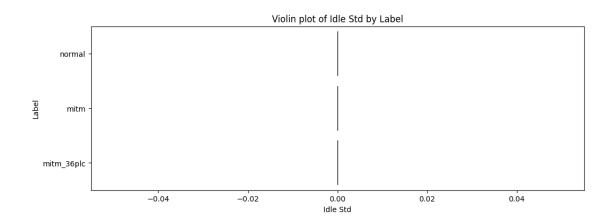


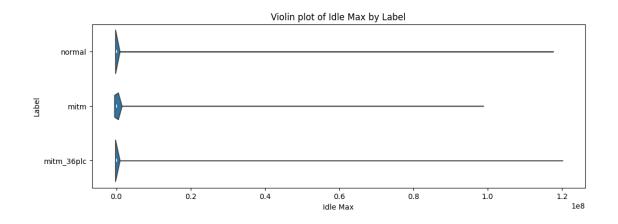


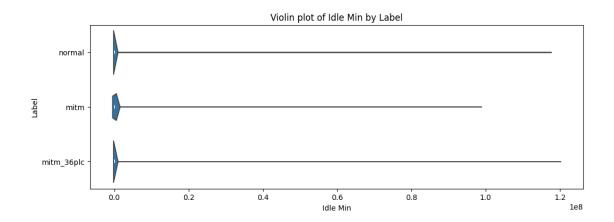












```
[33]: from scipy.stats import ttest_ind label_values = df['Label'].unique()
```

```
group1 = df[df['Label'] == label_values[0]]
group2 = df[df['Label'] == label_values[1]]

for col in df.select_dtypes(include='number').columns:
    stat, p = ttest_ind(group1[col], group2[col], nan_policy='omit')
    print(f'{col}: t={stat:.2f}, p={p:.4f}')
Protocol: t=nan, p=nan
```

Protocol: t=nan, p=nan Flow Duration: t=-21.20, p=0.0000 Tot Fwd Pkts: t=0.35, p=0.7259 Tot Bwd Pkts: t=-0.60, p=0.5465 TotLen Fwd Pkts: t=0.32, p=0.7456 TotLen Bwd Pkts: t=0.40, p=0.6891 Fwd Pkt Len Max: t=0.53, p=0.5948 Fwd Pkt Len Min: t=nan, p=nan Fwd Pkt Len Mean: t=-0.00, p=0.9984 Fwd Pkt Len Std: t=0.38, p=0.7070 Bwd Pkt Len Max: t=0.63, p=0.5314 Bwd Pkt Len Min: t=nan, p=nan Bwd Pkt Len Mean: t=0.83, p=0.4080 Bwd Pkt Len Std: t=0.65, p=0.5180 Flow Byts/s: t=73.69, p=0.0000Flow Pkts/s: t=37.37, p=0.0000Flow IAT Mean: t=-25.84, p=0.0000Flow IAT Std: t=-9.07, p=0.0000Flow IAT Max: t=-6.88, p=0.0000Flow IAT Min: t=-11.43, p=0.0000Fwd IAT Tot: t=-316.62, p=0.0000Fwd IAT Mean: t=-315.29, p=0.0000Fwd IAT Std: t=-283.50, p=0.0000Fwd IAT Max: t=-273.95, p=0.0000Fwd IAT Min: t=-108.79, p=0.0000Bwd IAT Tot: t=-21.18, p=0.0000 Bwd IAT Mean: t=-35.93, p=0.0000Bwd IAT Std: t=-6.34, p=0.0000Bwd IAT Max: t=-7.33, p=0.0000Bwd IAT Min: t=-333.73, p=0.0000Fwd PSH Flags: t=nan, p=nan Bwd PSH Flags: t=nan, p=nan Fwd URG Flags: t=nan, p=nan Bwd URG Flags: t=nan, p=nan Fwd Header Len: t=0.25, p=0.7998 Bwd Header Len: t=-0.40, p=0.6892 Fwd Pkts/s: t=73.45, p=0.0000 Bwd Pkts/s: t=37.32, p=0.0000Pkt Len Min: t=nan, p=nan Pkt Len Max: t=-0.26, p=0.7954Pkt Len Mean: t=0.37, p=0.7113

```
Pkt Len Std: t=0.28, p=0.7759
    Pkt Len Var: t=0.57, p=0.5680
    FIN Flag Cnt: t=0.06, p=0.9483
    SYN Flag Cnt: t=0.01, p=0.9946
    RST Flag Cnt: t=nan, p=nan
    PSH Flag Cnt: t=nan, p=nan
    ACK Flag Cnt: t=-0.01, p=0.9946
    URG Flag Cnt: t=nan, p=nan
    CWE Flag Count: t=nan, p=nan
    ECE Flag Cnt: t=nan, p=nan
    Down/Up Ratio: t=-0.03, p=0.9793
    Pkt Size Avg: t=0.37, p=0.7107
    Fwd Seg Size Avg: t=-0.00, p=0.9984
    Bwd Seg Size Avg: t=0.83, p=0.4080
    Fwd Byts/b Avg: t=nan, p=nan
    Fwd Pkts/b Avg: t=nan, p=nan
    Fwd Blk Rate Avg: t=nan, p=nan
    Bwd Byts/b Avg: t=nan, p=nan
    Bwd Pkts/b Avg: t=nan, p=nan
    Bwd Blk Rate Avg: t=nan, p=nan
    Subflow Fwd Pkts: t=0.35, p=0.7259
    Subflow Fwd Byts: t=0.32, p=0.7456
    Subflow Bwd Pkts: t=-0.60, p=0.5465
    Subflow Bwd Byts: t=0.40, p=0.6891
    Init Fwd Win Byts: t=nan, p=nan
    Init Bwd Win Byts: t=1.83, p=0.0675
    Fwd Act Data Pkts: t=-0.04, p=0.9661
    Fwd Seg Size Min: t=nan, p=nan
    Active Mean: t=-1.34, p=0.1815
    Active Std: t=nan, p=nan
    Active Max: t=-1.34, p=0.1815
    Active Min: t=-1.34, p=0.1815
    Idle Mean: t=-0.29, p=0.7725
    Idle Std: t=nan, p=nan
    Idle Max: t=-0.29, p=0.7725
    Idle Min: t=-0.29, p=0.7725
    /home/ics-security/anaconda3/envs/DATN/lib/python3.9/site-
    packages/scipy/stats/_axis_nan_policy.py:531: RuntimeWarning: Precision loss
    occurred in moment calculation due to catastrophic cancellation. This occurs
    when the data are nearly identical. Results may be unreliable.
      res = hypotest_fun_out(*samples, **kwds)
[]: # from sklearn.preprocessing import LabelEncoder
     # # Create and fit the encoder
     # le = LabelEncoder()
     # df['Label_encoded'] = le.fit_transform(df['Label'])
```

```
# # Create mapping dictionary
     {\it \# label\_mapping = dict(zip(le.classes\_, le.transform(le.classes\_)))}
     # print("Label to Integer Mapping:")
     # for label, code in label_mapping.items():
           print(f'''\{label\}' \rightarrow \{code\}'')
    Label to Integer Mapping:
    'mitm' → O
    'mitm_36plc' → 1
    'normal' → 2
[]: # reverse_mapping = dict(zip(le.transform(le.classes_), le.classes_))
     # print("\nInteger to Label Mapping:")
     # for code, label in reverse_mapping.items():
          print(f"{code} → '{label}'")
    Integer to Label Mapping:
    O → 'mitm'
    1 → 'mitm_36plc'
    2 → 'normal'
[]:
```